



Final Site Selection Report

December 18, 2007

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FUTUREGEN INDUSTRIAL ALLIANCE, INC.
1001 PENNSYLVANIA AVENUE, NW
6TH FLOOR
WASHINGTON DC 20004
202-429-8430
Email: info@FutureGenAlliance.org
Homepage: www.FutureGenAlliance.org

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Submitted by:

FutureGen Industrial Alliance, Inc.

SUMMARY

FutureGen is a government-industry cost-shared project to design, build, and operate a first-of-a-kind coal-fueled, near-zero emission power plant. The FutureGen power plant will produce electricity and hydrogen from coal while capturing and permanently storing carbon dioxide (CO₂) in a deep geologic formation. On December 2, 2005, the U.S. Department of Energy (DOE) entered into a cooperative agreement with the FutureGen Industrial Alliance, Inc. (Alliance) to begin the FutureGen host site selection process and prepare a conceptual design for the facility.

The Alliance implemented a thoughtfully 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 DOE. The four sites under consideration to host the FutureGen facility are located in Mattoon, Illinois; Tuscola, Illinois; Jewett, Texas (also referred to as Heart of Brazos); and Odessa, Texas.

In accordance with the National Environmental Policy Act, DOE prepared a Draft and a Final environmental impact statement (EIS) to evaluate the potential environmental impacts of constructing and operating the FutureGen project at each of the four sites. In the Final EIS, DOE stated that its preferred alternative is to provide financial assistance to the FutureGen project and tentatively found that all four sites were acceptable. The Alliance expects that, in the near future, DOE will issue a Record of Decision that states that it will implement its preferred alternative and confirms that each of the four sites is acceptable. The Alliance will implement mitigation measures specified in the DOE Record of Decision.

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 voted to select **Mattoon** as the host site for the FutureGen facility, pending the outcome of DOE's Record of Decision. While the Alliance believes that all of the candidate sites are acceptable and offer significant benefits to the FutureGen project, the Alliance believes the Mattoon site provides many advantages, among which are the following:

- The Mattoon site proponent can provide clear legal title to the power plant site, 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.
- Enhanced, site-specific environmental mitigation measures will be implemented to reduce, to the fullest extent practicable, potential impacts from light, noise, and odors and to increase the compatibility of the plant with the surrounding area.
- 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, Mattoon would best serve the overall project mission.

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ACRONYMS AND ABBREVIATIONS

BAFO	Best and Final Offer
CO ₂	carbon dioxide
DOE	U.S. Department of Energy
EIS	environmental impact statement
MMT	million metric tons
MMV	monitoring, mitigation, and verification
MW	megawatt
NEPA	National Environmental Policy Act
TDCJ	Texas Department of Criminal Justice

1.0 INTRODUCTION

FutureGen is a government-industry cost-shared project to design, build, and operate a first-of-a-kind coal-fueled, near-zero emission power plant. The FutureGen power plant will produce electricity and hydrogen from coal while capturing and permanently storing carbon dioxide (CO₂) in a deep geologic formation. The nominally rated 275-megawatt (MW) prototype power plant will operate as a production plant, generating commercially significant levels of electric power. It will also provide a large-scale engineering laboratory for testing new and clean power generation, CO₂ capture, and coal-to-hydrogen technologies, as well as including syngas slip-stream access for testing and developing new technologies. The FutureGen program intends to build and operate the cleanest coal-fueled power plant in the world.

The project is being jointly funded by the U.S. Department of Energy (DOE) and the FutureGen Industrial Alliance, Inc. (Alliance). There were four candidate sites under consideration to host the FutureGen facility. The sites are located in Mattoon, Illinois; Tuscola, Illinois; Jewett, Texas (also referred to as Heart of Brazos); and Odessa, Texas.

The Alliance engaged in a detailed discussion of the strengths and weaknesses of each site individually and performed a side-by-side comparison of the sites looking specifically at costs (including uncertainties), risks to cost and schedule, and other benefits. After this extensive review and evaluation of the advantages and disadvantages of the four candidate sites both individually and in comparison to one another, the Alliance Board of Directors voted to select **Mattoon** as the host site for the FutureGen facility, pending the outcome of future DOE decisionmaking.

This report summarizes the siting process that was used to identify candidate sites and, ultimately, to select one of those sites as the host site. In addition, the report provides an overview of the costs, revenues, and incentives; risks to cost and schedule; and other benefits associated with constructing and operating FutureGen at each of the candidate sites. With that background, the report then provides the rationale for selecting Mattoon as the host site. DOE reviewed and approved the final site selection process.

2.0 FUTUREGEN FACILITY SITING PROCESS

The Alliance implemented a thoughtfully structured, openly competitive siting process to identify the site that could best meet the goals of the FutureGen project. The process used is summarized below.

Request for Proposals

On December 2, 2005, DOE entered into a cooperative agreement with the Alliance to begin the FutureGen host site selection process and prepare a conceptual design for the facility. As a result, the Alliance created a process to identify candidate sites for the proposed FutureGen facility. This process involved developing over 75 different siting criteria, issuing a Request for Proposals, and evaluating the proposals received using a scoring system, including a visit to each proposed site.

Candidate Site List

In July 2006, the Alliance identified four candidate sites to host the FutureGen facility, out of 12 sites for which proposals were submitted. The candidate sites were selected after completion of a rigorous proposal evaluation process, which was independently audited by DOE. The Candidate Site List, and supporting rationale, was submitted to DOE for inclusion into the agency's National Environmental Policy Act (NEPA) compliance process. The Alliance's *Report to the U.S. Department of Energy on the Results of Site Offeror Proposal Evaluation*, dated July 21, 2006, provides additional detail.

Environmental Impact Statement

In accordance with its NEPA regulations, DOE analyzed the potential environmental impacts of siting and constructing the FutureGen facility at each of the four candidate sites and documented these analyses in the *FutureGen Draft Environmental Impact Statement* (DOE/EIS-0394D, May 2007) (Draft EIS). The Draft EIS was the subject of public hearings at the four sites. DOE considered the public comments received on the Draft EIS and issued the *FutureGen Final Environmental Impact Statement* (DOE/EIS-0394F, November 2007) (Final EIS). A Notice of Availability of the Final EIS was published by the U.S. Environmental Protection Agency on November 16, 2007 (72 Fed. Reg. 64618, 64619 [November 16, 2007]), beginning the minimum 30-day waiting period required by NEPA regulations.

Record of Decision

In the Final EIS, DOE stated that its preferred alternative is to provide financial assistance to the FutureGen project and tentatively found that all four sites were acceptable. The Alliance expects that, in the near future, DOE will issue a Record of Decision that states that it will implement its preferred alternative and confirms that each of the four sites is acceptable. The Alliance will implement mitigation measures specified in the DOE Record of Decision.

Data Analysis

The Alliance considered the costs, risks, and benefits associated with the construction and operation of the FutureGen facility at each of the four candidate sites. All phases (construction, operation, post-operation, and long-term monitoring) and significant components (power plant, utility requirements, and sequestration) of the plant were evaluated – over 120 different factors. The data for this analysis was derived from several sources including, but not limited to:

- Best and Final Offer (BAFO) submissions from the proponents of the candidate sites;¹
- Original site proposals; and
- Alliance due diligence efforts, including legal and financial analyses.

¹ BAFO Directions were provided to the site proponents in draft on May 30, 2007. These directions were modified after consideration of comments received from the site proponents, and final directions were sent to the site proponents on June 15, 2007. The BAFO directions describe the general factors the Alliance intends to consider in its final siting decision. BAFOs were submitted by the site proponents on August 1, 2007.

3.0 CAPITAL AND OPERATING COSTS, EXPECTED REVENUES, AND INCENTIVES

For each of the candidate sites, the Alliance considered the expected capital and operating costs, potential revenues, and potential incentives offered by the site proponents. Capital costs are those that will need to be expended over a 44-month construction period for (1) purchasing or leasing land for the power plant and/or injection site, required rights-of-way for utilities and a CO₂ pipeline, and subsurface rights needed for CO₂ sequestration; (2) preparing the power plant site for construction (e.g., road access, grading, natural gas pipeline work); (3) constructing the power plant (e.g., cost of construction labor and weather-driven costs); (4) sequestration design and construction (e.g., site characterization, building the CO₂ pipeline system and infrastructure, and monitoring infrastructure); and (5) environmental mitigation (e.g., noise attenuation barriers and odor controls). Operating costs are those that will need to be expended for the 4-year operations period of the power plant (e.g., coal and other consumables), the 4-year operations period of the sequestration system (e.g., CO₂ pipeline operations and maintenance and monitoring, mitigation, and verification (MMV)), and the 2-year post-operation period (e.g., continued MMV, injection well closure, and CO₂ pipeline closure).

The operation of the FutureGen facility is expected to generate revenue from the sale of electricity and of co-products such as elemental sulfur and slag. In addition, CO₂ sales would be possible if the plant were located at one candidate site – Odessa.

The site proponents offered various economic incentives in their best and final offers. In particular, both Illinois and Texas offered several million dollars in contributions and grants. Some of the grants require applications to be filed and/or certain conditions to be met.

The site proponents in both states also offered in-kind contributions. These include MMV services valued at least \$1 million annually. Other in-kind contributions offered include equipment, research, and services.

The following addresses the expected costs, revenue, and incentives for each site.

Mattoon

- Capital costs are comparatively high and are driven by construction labor, grid upgrades, and weather-driven requirements.
- Operating costs are comparatively low and are driven by coal delivered costs, CO₂ pipeline operations and maintenance, and operations labor.
- Total revenue is expected to be \$216 million over 4 years, of which \$215 million is expected to come from electricity sales.
- The value of incentive contributions and grants is \$21 million.

Tuscola

- Capital costs are comparatively high and are driven by construction labor, grid upgrades, weather-driven requirements, and the potential future need for a process water treatment facility.
- Operating costs are comparatively low and are driven by coal delivered costs, water, and operations labor.
- Total revenue is expected to be \$216 million over 4 years, of which \$215 million is expected to come from electricity sales.
- The value of incentive contributions and grants is \$21 million.

Jewett

- Capital costs are comparatively high and are driven by the need for a process water treatment facility and a CO₂ pipeline system.
- Operating costs are comparatively high and are driven by coal delivered costs, water treatment costs, and sequestration requirements.
- Total revenue is expected to be \$231 million over 4 years, of which \$230 million is expected to come from electricity sales.
- The value of incentive contributions and grants is \$20 million.
- Texas offered the Alliance franchise tax credits (based on electricity sales), subject to a cap. Although the Alliance is not subject to the franchise tax, the Alliance extensively analyzed the ability to sell the credits to entities that are subject to the tax in order to realize value from the credits. However, the value of any such credits to the Alliance is highly uncertain because of the unique nature of the credits, the lack of tried and tested state regulations implementing the credits, the unknown extent of the available market for the credits, and the uncertainty of electricity sales during the initial part of the facility's operating period. In addition, there is a risk that entities that are eligible for a franchise tax credit may not be eligible for the offered school district tax abatements.

Odessa

- Capital costs are comparatively low and are driven by process water treatment facility requirements, weather-driven requirements, and sequestration design and construction.
- Operating costs are comparatively high and are driven by coal delivered costs, water and water treatment requirements, and sequestration requirements.

- Total revenue is expected to be \$201 million over 4 years, of which \$190 million is expected to come from electricity sales and \$10 million is expected to come from CO₂ sales.
- The value of incentive contributions and grants is \$25 million.
- Texas offered the Alliance franchise tax credits (based on electricity sales), subject to a cap. Although the Alliance is not subject to the franchise tax, the Alliance extensively analyzed the ability to sell the credits to entities that are subject to the tax in order to realize value from the credits. However, the value of any such credits to the Alliance is highly uncertain because of the unique nature of the credits, the lack of tried and tested state regulations implementing the credits, the unknown extent of the available market for the credits, and the uncertainty of electricity sales during the initial part of the facility's operating period. In addition, there is a risk that entities that are eligible for a franchise tax credit may not be eligible for the offered school district tax abatements.

With respect to cost and cost components, there is no one site that clearly stands out as the best. For this reason, the other differentiating factors included in the overall siting analysis magnify in importance.

4.0 RISKS TO COST AND SCHEDULE

In considering risks to cost and schedule, the Alliance considered legal issues, water issues, geologic conditions and sequestration, construction capability, and environmental issues at each site.

Legal issues refer to the ability to obtain clear, unencumbered title to the proposed power plant site and the ability to obtain the necessary easements or other rights for utility corridors, the CO₂ pipeline, the installation of monitoring equipment as required over the 6-year plume, and the use of geologic reservoirs for the permanent storage of injected CO₂.

Water issues refer to the volume of water that is available, the ability to access the water when needed, and the quality of the water.

Geologic conditions and sequestration refer to the general characteristics of the target formation to store CO₂, including permeability, thickness and other factors that might impact design of the sequestration and monitoring systems, the number and thickness of caprock seals, and scientific research opportunities.

Construction capability refers to the availability of construction labor and opportunities to maximize construction efficiencies to avoid schedule delays.

Environmental issues refer to the land use of the surrounding area and the presence or absence of any sensitive receptors or resources in the area.

The following addresses these factors for each site.

Mattoon

- *Legal issues:* The Alliance would generally be able to acquire marketable title (or equivalent site control) to the proposed 419-acre power plant site, which includes the injection site. The site proponent is or will be in control of all necessary utility and transportation corridors; no CO₂ corridor is required. Modeling results suggest that the 6-year CO₂ plume would remain on the proposed site or within adjacent acreage controlled by the site proponent. As a charitable organization, the Alliance is highly likely to be eligible for a property tax exemption.
- *Water issues:* Process water would be supplied from effluent from city wastewater treatment plants in Mattoon and Charleston, Illinois. With the construction of a 7- to 10-acre reservoir on the site, process water would be available in sufficient quantities even in dry conditions. The quality of the water is good, although it will need additional treatment.
- *Geologic conditions and sequestration:* The geologic features of the injection reservoir and seals combine to produce a sequestration setting that is chemically, physically, and structurally robust. The target formation is the regionally extensive Mt. Simon sandstone formation. The Mt. Simon at the Mattoon site is the deepest reservoir as compared to the other sites. The reservoir caprock is the thick Eau Claire shale that serves as a competent caprock for natural gas storage reservoirs elsewhere in Illinois. Multiple secondary seals also exist at the site to provide backup to the main seal. The tectonic setting is stable and in a compressive regional stress regime, which further increases the likelihood that any undetected fracture zones at the site would be sealing. A recent seismic survey near the site shows no obvious faults within the sequestration area. No existing wellbores penetrate the primary seal within the 50-million metric ton (MMT) plume footprint, eliminating a potential leakage risk and well remediation expenses. Reservoir simulations conducted using reservoir property data supplied by the site proponent show that a single well would support a design basis injection rate of 2.5 MMT annually. However, because the reservoir property data used in the simulations were obtained from a well located over 50 miles away, there is uncertainty in achieving the modeled injectivity rate of 2.5 MMT annually in a single well under actual reservoir permeability conditions at the site. Additional simulations were conducted assuming the use of as little as one-third of the total reservoir thickness and still resulted in the ability to inject at a 2.5-MMT annual rate. Further, low injectivity could be mitigated by the installation of a second injection well or by installing a horizontal well at additional cost. Considering all of these factors, this site has a low probability of encountering geologic conditions that would make it impracticable to engineer a sequestration system to achieve the required CO₂ injection rate.
- *Construction capability:* Having the power plant and injection infrastructure located on the same site would allow for construction and operation integration efficiencies by being able to use the same team for surface and subsurface activities. In addition, the site is located near interstate highways which connect to major waterways to provide an opportunity for modular construction of the facility. Labor rates are higher in Illinois than in Texas, and the Illinois sites could experience weather-related construction delays. Because the Mattoon site is located near residences, the ability to work around the clock may also be limited. The nearest transmission line is a 138-kV line, and the lower voltage increases the potential for system congestion. A 345-kV

line is located approximately 16 miles away; a tie-in to that line could require 4 to 5 years for permitting and construction, adversely affecting the FutureGen schedule.

- *Environmental issues:* The current land use is agricultural. The surrounding area is rural with a low population density. Two residences are located adjacent to the site. An elementary school is located approximately 2 miles southeast of the proposed site. Enhanced, site-specific environmental mitigation measures would be implemented to reduce potential light, noise, and odor impacts to the local community to the fullest extent practicable. In addition, as required by DOE in its Record of Decision, the Alliance would consider other environmental mitigation measures such as (but not limited to) enclosing or shielding some components of the plant and landscaping around the perimeter of the plant site to partially screen the plant from nearby residences.

Tuscola

- *Legal issues:* The Alliance would have clear title to the proposed 349-acre power plant site. Some existing easements (e.g., natural gas lines) would affect the placement of the power plant on the site, or would require that the easements be modified. The Alliance would also have clear title to the 10-acre injection site located approximately 11 miles south of the power plant site. With one exception, all property owners above the 6-year plume have signed options for storage deeds for the area between 3,500 and 8,000 feet below the surface and have also agreed to surface access for MMV, including drilling monitoring wells. The 6-year plume could come within 600 feet or less of an existing shallow gas storage field, requiring extra diligence during drilling to ensure the integrity of the gas storage field; indemnification of the owner of the gas storage field may also be required. The site proponent does not have complete control over the rights-of-way needed for utilities, transportation corridors, and the CO₂ pipeline; use of eminent domain to obtain the required rights is likely. As a charitable organization, the Alliance is highly likely to be eligible for a property tax exemption.
- *Water issues:* Process water would be supplied from the Kaskaskia River through a pipeline controlled by the Lyondell-Equistar Company. A sufficient volume is available and the water quality is good. Lyondell-Equistar is in the process of being sold to another company and the Alliance has been unable to reach an agreement regarding the future availability of river access. Should the pipeline and existing water treatment plant become unavailable, the Alliance would need to find another access route to the Kaskaskia River water.
- *Geologic conditions and sequestration:* Similar to Mattoon, the target formation would be the regionally extensive Mt. Simon formation with geologic features and seals combining to produce a sequestration setting that is chemically, physically, and structurally robust. The reservoir caprock is the thick Eau Claire shale that serves as a competent caprock for natural gas storage reservoirs elsewhere in Illinois. Multiple secondary seals also exist at the site to provide backup to the main seal. The tectonic setting is stable and in a compressive regional stress regime, which further increases the likelihood that any undetected fracture zones at the site would be sealing. A recent seismic survey near the site shows no obvious faults within the sequestration area. The principal difference from the Mattoon site is a shallow (<2 degree) dip of the reservoir to the

southeast. This would cause an asymmetrical distribution of the CO₂, extending the plume farther to the northwest and expanding the acreage beyond the estimates made with a simple, radially symmetric reservoir model. The Tuscola site is also surrounded by mature and abandoned petroleum exploration and production wells, one of which penetrates the New Albany secondary seal above the 50-MMT plume footprint. However, none of the known wells penetrates the primary seal. Similar to the Mattoon site, there is uncertainty in achieving the modeled injectivity rate of 2.5 MMT annually in a single well because of uncertainty in reservoir permeability in this deep reservoir. Because of the limited acreage offered for the sequestration site, installation of a second injection well would not be a mitigation option due to pressure interference over short inter-well distances. Installing a horizontal well at additional cost would be the only corrective option for low injectivity at the Tuscola site.

- *Construction capability:* The site is located near interstate highways which connect to major waterways to provide an opportunity for modular construction of the facility. Labor rates are higher in Illinois than in Texas, and the Illinois sites could experience weather-related construction delays. There is a large natural gas mainline located on the property that would need to be moved prior to construction. The nearest transmission line is a 138-kV line, and the lower voltage increases the potential for system congestion. A 345-kV line is located approximately 17 miles away; a tie-in to that line could require 4 to 5 years for permitting and construction, adversely affecting the FutureGen schedule.
- *Environmental issues:* The current land use is agricultural. The site is located adjacent to an existing industrial area. Three residences, which would be purchased, are located adjacent to the site; 7 other residences are located within 0.5 miles of the site. As required by DOE in its Record of Decision, the Alliance would consider other environmental mitigation measures such as (but not limited to) enclosing or shielding some components of the plant and landscaping around the perimeter of the plant site to partially screen the plant from nearby residences.

Jewett

- *Legal issues:* The Alliance would have clear title to the proposed 400-acre power plant site. However, existing encumbrances (e.g., oil and gas leases) may affect use of the site, and the Alliance would need to negotiate with leaseholders to restrict the leaseholders' activities so as not to interfere with construction or operation of the FutureGen plant. The injection site would be located approximately 50 miles away on 800 acres of land owned by and leased from the Texas Department of Criminal Justice (TDCJ).² The TDCJ owns only 1/8th of the mineral interests in the subsurface area. However, Texas case law has been interpreted to require permission from only the surface owner (not the mineral owner) for right to inject and store CO₂ in a subsurface formation that is not productive of oil and gas. The possibility exists that an affected mineral owner could seek a storage fee or damages, if provable. Modeling results show that the 6-year CO₂ plume (encompassing approximately 1,650 acres) may not remain on the 800-acre site. Rights-of-way would not be required for utility or transportation corridors. The Alliance would construct and operate the 59-mile CO₂ pipeline. Rights-of-way have not been obtained, but

² Use of the TDCJ property as the injection site for Jewett is the reference case. Use of property owned by the Hill Family as the injection site raised concerns regarding faulting in the area, concerns that are not present on the TDCJ property.

common practice in Texas indicates that such rights would be granted. If the use of eminent domain were required, the Alliance would need to become or work with a common carrier.

- *Water issues:* Process water is proposed to be provided from a combination of onsite and offsite groundwater wells and blowdown water. Mine water is also available. Sufficient volume is available from a variety of sources, although the quality of blowdown and mine water is poor and other sources were not quantified by the site offeror. In all cases, the Alliance would need to reach agreement with NRG regarding the use of the water from their offered and/or identified sources.
- *Geologic conditions and sequestration:* The primary target formation is the highly porous and permeable Woodbine sandstone that provides high capacity for CO₂ injection. Although highly permeable, the Woodbine is also the thinnest of the proposed reservoirs (600 feet total) and so generates the largest plume footprint of the sites. The site also has the heterogeneous Travis Peak sandstones that provide opportunities for research on low permeability, very deep (>10,000 feet) reservoirs. The primary seal is the thick Eagle Ford shale that is immediately overlain by another thick secondary seal, the Austin chalk. The injection site is in an area of active oil and gas exploration and production. There are numerous wells in the area, although none would intersect the 6-year plume. Several existing wells would require remediation should plant operations continue. The closest seismic line, located less than 0.1 mile from the proposed TDCJ injection site, shows no clearly identifiable faults. However, the Jewett site is in a regional stress regime that is extensional in nature. Although the likelihood is low, should presently undetected faults and fracture zones exist at the site, these structures would be at somewhat higher risk of opening under stresses and frictional changes induced from CO₂ injection.
- *Construction capability:* The site is located near interstate highways which connect to major waterways to provide an opportunity for modular construction of the facility. NRG, which operates the adjacent Limestone coal-fired power plant, is building a third unit, which is expected to be completed in 2012. This could put a strain on the availability of construction labor for the FutureGen plant. The proximity of the NRG Limestone plant could also provide synergies with FutureGen that have not been identified or valued. A 345-kV transmission line is located adjacent to the proposed power plant site, reducing the potential for congestion.
- *Environmental issues:* The proposed plant site is located adjacent to an operating lignite mine and an operating coal-fired power plant. There are no residences near the proposed power plant site. The proposed injection site is located on property which also houses several thousand state prisoners. According to Census data, approximately 100 people reside above the modeled 6-year plume; 7,000 currently reside above the modeled 50-MMT plume.

Odessa

- *Legal issues:* The proposed plant site is currently subject to oil and gas leases, pipelines, and other encumbrances, and the Alliance would need to negotiate with leaseholders to restrict their activities so as not to interfere with construction or operation of the FutureGen plant. The proposed injection site would be located approximately 80 miles away on land owned by and

leased from the University of Texas System; four well sites would be leased for a total of 648 acres. Modeling results show that the 6-year CO₂ plume would remain within the 648 leased acres. The site proponent obtained a letter of commitment from the affected landowner for a transmission line easement; no other utility or transportation rights-of-way would be required. To the extent that new CO₂ pipelines are required, they would be sited, constructed, and operated by third parties which, as common carriers, may be able to use eminent domain to obtain the necessary easements if necessary.

- *Water issues:* Process water would be supplied by the City of Odessa through a new water pipeline to the proposed site. There is adequate volume available, although the quality of the water is poor.
- *Geologic conditions and sequestration:* The targeted injection zone is the Delaware Mountain Group sandstones. This porous sandstone interval is overlain by dominantly non-porous and impermeable carbonates of the Goat Seep Limestone. The primary seal is a very thick (700 feet) anhydrite mixed with minor amounts of carbonate and halite followed by another thick anhydrite (500 feet) of the Salado Formation. The Odessa injection reservoir is the shallowest of the sites and is also of the lowest overall permeability, based on data provided by the site proponent. Hence, achieving the targeted 1-MMT annual injection rate would require multiple vertical wells and/or a horizontal well. The low permeability and the option to mix horizontal and vertical wells to meet injectivity requirements offer significant scientific research opportunities unique to the Odessa site. Based on available seismic data, there is no evidence of faults cutting the primary caprock seal or any of the overlying formations. There are numerous caprock penetrations in the general area due to oil and gas exploration, but there is sufficient acreage to allow the required number of vertical and/or horizontal wells to be positioned to avoid plume contact with existing wells. The CO₂ produced at the FutureGen plant would be co-mingled with CO₂ produced elsewhere before injection. The sequestration system design basis was established at 1 MMT of CO₂ to be injected annually and any additional produced CO₂ would be sold. The costs of a dedicated CO₂ pipeline to eliminate co-mingling and the additional wells needed to allow the sequestration of more than 1 MMT of CO₂ annually have not been estimated but would be high because of the large distance (>50 miles) between the plant and sequestration site.
- *Construction capability:* This site poses the least risk of construction labor shortages and allows for the most predictable construction schedule. The plant would tie into a double-circuit 138-kV transmission line. Being located in a relatively unpopulated area, the West Texas transmission system has limited capacity and is not highly networked. This increases the potential for congestion with new generation. Based on information from the Texas BAFO, 4,500 MW of commercial windpower is being developed in the region. However, the region has been designated as a Certified Renewable Energy Zone, which allows grid upgrades in the area to be given priority. In addition, a utility joint venture has been formed specifically to increase the transmission capacity in Certified Renewable Energy Zones, including West Texas. Although the potential for congestion exists at this site, the situation could improve substantially by the time the FutureGen plant is online. Due to the absence of a major waterway in the vicinity, this site offers the least opportunity for modular construction as compared to the other three sites.

- *Environmental issues:* The proposed power plant site is in a rural area and is currently partially used for natural gas activities. The area surrounding the site to the east, west, and north is dominated by ranching and oil and gas activities. Industrial facilities and the largely abandoned town of Penwell are located adjacent to the site, to the south. There are 4 residences (which may be abandoned) located within 0.5 miles of the proposed power plant site.

All sites pose advantages and disadvantages with respect to risks to cost and schedule. Overall, the Alliance believes that selection of the Mattoon site will pose the least risk because of certainties in obtaining legal control of the site and necessary easements, the availability of process water for the facility, and the soundness of the geologic target formation.

5.0 BENEFITS

- All sites enjoy strong stakeholder support for the FutureGen plant.
- The use of eminent domain is available in both states, although it is likely that the states would decline to use that power except as a last resort. In Texas, the use of a general eminent domain (e.g., to resolve title issues) requires that the necessary funds be authorized and appropriated by the Texas legislature.
- All sites offer opportunities for co-product sales such as elemental sulfur and slag; Odessa offers the opportunity for CO₂ sales.
- All sites provide important scientific research opportunities and transferability of geologic sequestration results.
- All sites offer a high potential for university involvement for both the power plant and geologic sequestration components of the project.
- By virtue of specially enacted state legislation, both states would take “all rights, title, and interest” in the CO₂ injected into the target formation and both states offer liability protection to the Alliance. The Illinois statute states that Illinois will take ownership of “all sequestered gases” and that the state will “indemnify, hold harmless, defend, and release the Alliance and member companies from any public liability for damages arising once the gas is injected into the wellhead.” Legal counsel believes that the Texas statute will be interpreted to include other gases that are included within the CO₂ stream.

All sites offer significant benefits to the Alliance and the FutureGen project, with no one site having a particular advantage over the others with respect to the benefits.

6.0 DECISION

The Alliance selects **Mattoon** as the host site for the FutureGen facility. Although, as discussed above, all candidate sites are acceptable and offer significant benefits to the FutureGen project, the Alliance believes the Mattoon site provides many clear advantages and minimal disadvantages.

Legal Issues

- The Mattoon site proponent can provide clear legal title to the power plant site, including the injection site, which results in minimal land ownership risk.

Water

- There is a secure water source from two city wastewater treatment facilities, which when combined with the construction and operation of an onsite reservoir, will ensure an adequate water supply to the plant.

Geologic Conditions and Sequestration

- Onsite injection eliminates the need for an extended length, offsite CO₂ pipeline, which reduces capital and operating costs while providing an excellent test of the integration of the power plant with CO₂ injection and sequestration. In addition, onsite injection configures the FutureGen plant in a manner that appears to be a high-probability design (onsite or near-onsite injection) for future near-zero emission power plants.
- 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. In addition, the Mt. Simon formation is representative of the majority of U.S. and world geologic storage capacity and provides a favorable geologic setting for groundbreaking research.
- The thick geologic injection formation, multiple thick overlying and low permeability formations which provide multiple seals, and lack of penetrations to both the primary or secondary seals substantially decrease geologic risk.
- The Mattoon site would have the smallest CO₂ plume footprint of all the candidate sites.
- The Mattoon site provides unfettered access to conduct a world-class monitoring program.
- This site presents the fewest issues for continuing operations because there are no wells that penetrate the caprock seals within the modeled 50-year CO₂ plume and there are no reservoir capacity issues. The site proponent controls a significant portion of the land area above the 50-year plume.

Construction Capability

- There is a highly skilled construction labor force available in the region.
- Onsite injection offers both construction and operational efficiencies by being able to use the same team for surface and subsurface activities.

- The site is near interstate highways which connect to major waterways to provide an opportunity for modular construction of the facility.
- All necessary utilities – rail, transmission, and natural gas – are adjacent or close by the site.

Environmental Issues

- The potential for environmental impacts is low. The power plant/injection site is cropland that has been farmed extensively, reducing the potential for undiscovered cultural, historic, or natural resources. Utility corridors will be located primarily along existing rights-of-way which also reduces the potential for undiscovered resources.
- Enhanced environmental mitigation measures will be implemented to reduce, to the fullest extent practicable, potential impacts from light, noise, and odors and to increase the compatibility of the plant with the surrounding area. In addition, as required by DOE in its Record of Decision, the Alliance will consider other environmental mitigation measures such as (but not limited to) enclosing or shielding some components of the plant and landscaping around the perimeter of the plant site to partially screen the plant from nearby residences.

Cost

- The Mattoon site offers significant coal transportation cost advantages, including the opportunity to transport all coal types economically.
- There is a good potential for self-sufficient post-project operation of the plant because of the power plant's projected revenue potential and projected low operating cost of the FutureGen plant at this site.
- The incentives provided by Illinois and the local community are significant and certain.

Other Considerations

- Illinois has enacted meaningful CO₂ storage legislation to benefit the Alliance, including a level of liability protection.
- The Mattoon site is located in a business enterprise zone which creates a favorable tax environment.
- The Illinois Geologic Survey is strongly supportive of the project and has offered to provide valuable MMV services during and after the project period.
- The state has enacted legislation to provide a streamlined environmental permitting process for the FutureGen project.
- There is ready access to world-class universities and research institutions that focus on coal and carbon sequestration.

- There is very strong community support for the FutureGen project in Mattoon and surrounding communities.

7.0 CONCLUSION

As described above, the Alliance has undertaken a rigorous, open site selection process that has been approved by DOE. After careful consideration of the advantages and disadvantages offered at each of the four candidate sites, the Alliance believes that the Mattoon site can best meet the goals of the FutureGen project within the current schedule and budget.