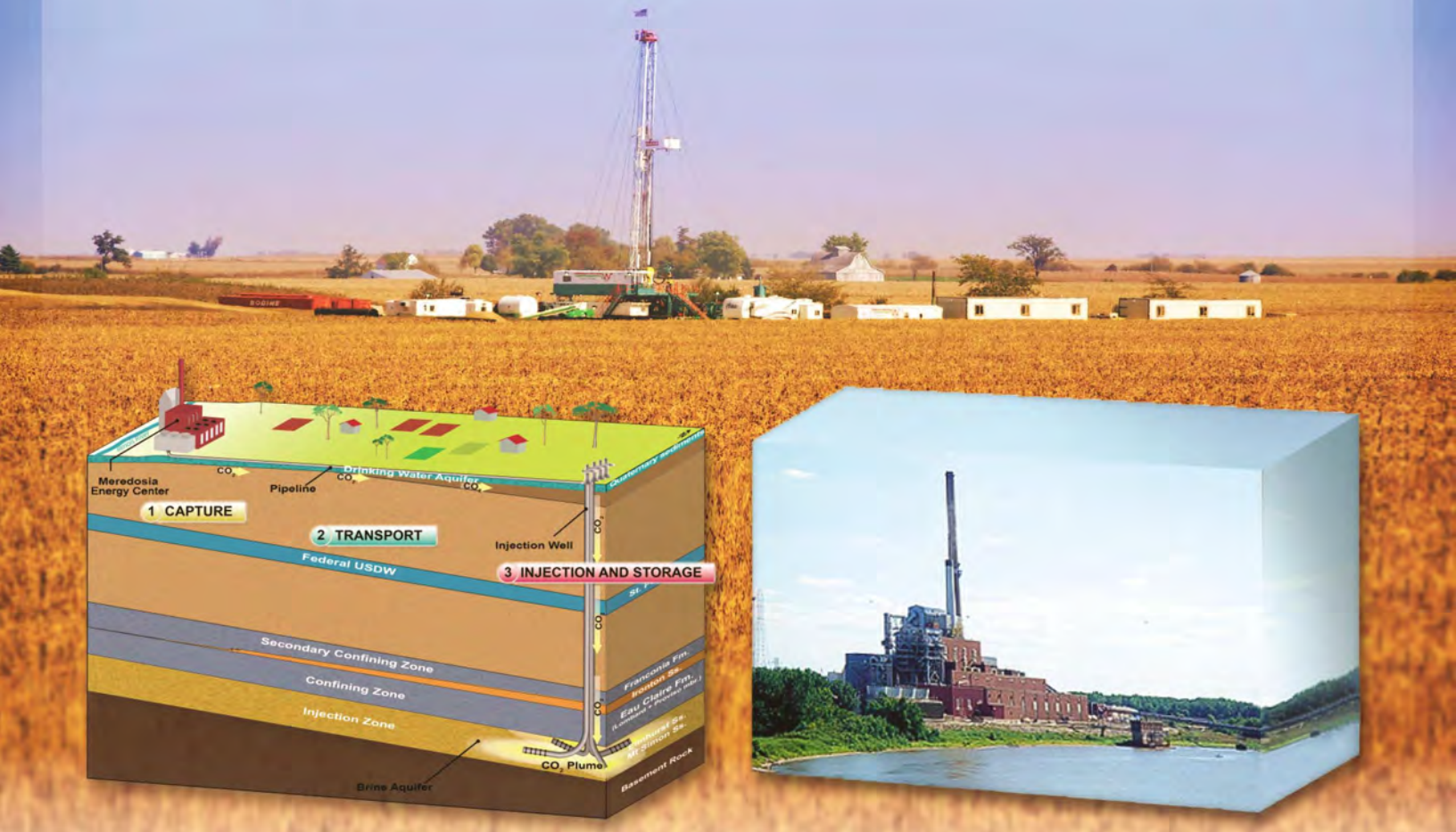
U.S. Department of Energy

FutureGen 2.0 Project

Final Environmental Impact Statement

DOE/EIS-0460 | October 2013



Summary

Office of Fossil Energy
National Energy Technology Laboratory

COVER SHEET

Responsible Federal Agency: U.S. Department of Energy (DOE)

Cooperating Agencies: None

Title: Final Environmental Impact Statement for the FutureGen 2.0 Project (DOE/EIS-0460)

Location: Morgan County, Illinois

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Abstract:

This Environmental Impact Statement (EIS) evaluates the potential impacts associated with DOE's proposed action to provide financial assistance to the FutureGen Industrial Alliance (the Alliance) for the FutureGen 2.0 Project, including the direct and indirect environmental impacts from construction and operation of the proposed project. DOE's proposed action would provide approximately $1 billion of funding (primarily under the American Recovery and Reinvestment Act) to support construction and operation of the FutureGen 2.0 Project. The funding would be used for project design and development, procurement of capital equipment, construction, and to support a 56-month demonstration period for a coal-fueled electric generation plant integrated with carbon capture and storage.

For the FutureGen 2.0 Project, the Alliance would construct and operate a 168-megawatt electrical (MWe) gross output coal-fueled electric generation plant using advanced oxy-combustion technology. The plant would use existing infrastructure, including the existing steam turbine generator (Unit 4), at Ameren Energy Resources' Meredosia Energy Center on the Illinois River just south of Meredosia, Illinois. The proposed project would include facilities designed to capture at least 90 percent of the carbon dioxide (CO_2) that would otherwise be emitted to the atmosphere **during steady-state operation**, equivalent to approximately 1.2 million tons (1.1 million metric tons) of CO_2 captured per year. The captured CO_2 would be compressed and transported via a new underground pipeline, approximately 30 miles long and **nominally 10 to** 12 inches in diameter, to a geologic storage area in eastern Morgan County, where it would be injected and stored in the Mt. Simon Formation (a saline aquifer) approximately 4,000 feet below the ground surface. The project would also employ systems for the monitoring, verification, and accounting of the CO_2 being geologically stored. Visitor, research, and training facilities would be sited in the vicinity of Jacksonville, Illinois. The proposed project would provide performance and emissions data, as well as establish operating and maintenance experience, that would facilitate future large-scale commercial deployment of oxy-combustion technology and geologic CO_2 storage.

DOE is the lead federal agency responsible for preparation of this EIS. DOE prepared the EIS pursuant to the National Environmental Policy Act (NEPA) and in compliance with the Council on Environmental Quality (CEQ) implementing regulations for NEPA (40 Code of Federal Regulations [CFR] 1500 through 1508) and DOE NEPA implementing procedures (10 CFR 1021). The EIS evaluates the potential environmental impacts of the FutureGen 2.0 Project as part of DOE's decision-making process to

determine whether to provide financial assistance. The EIS also analyzes the no action alternative, under which DOE would not provide financial assistance for the FutureGen 2.0 Project.

Public Participation:

DOE encourages public participation in the NEPA process. The Notice of Availability of the Draft EIS appeared in the *Federal Register* on May 3, 2013, which invited comments on the Draft EIS through the end of the comment period on June 17, 2013. DOE conducted a public hearing for the Draft EIS in Jacksonville, Illinois, on May 21, 2013, which included an informational session for one hour prior to the formal hearing. During the hearing, the public was encouraged to provide oral comments and to submit written comments to DOE through the close of the comment period. DOE also considered late comments. A summary of the public hearing is included in new Appendix I along with all agency and public comments on the Draft EIS and DOE responses.

Changes from the Draft EIS:

In this Final EIS, bold text and vertical lines in the margin indicate where the Draft EIS has been revised or supplemented (as exemplified by this paragraph). Deletions are not demarcated. Additions to the appendices in Volume II are indicated on the appendix cover sheets with vertical lines in the margin and bold text.

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Acronyms

Acronym	Definition
CCPI	Clean Coal Power Initiative
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CO_2	carbon dioxide
dBA	A-weighted sound level in decibels
DOE	U.S. Department of Energy
EIS	Environmental Impact Statement
FR	Federal Register
GHG	greenhouse gas
IDNR	Illinois Department of Natural Resources
IDOA	Illinois Department of Agriculture
IGCC	integrated gasification combined cycle
ILCS	Illinois Compiled Statutes
MVA	monitoring, verification, and accounting
MWe	megawatt electrical
NEPA	National Environmental Policy Act
NOA	Notice of Availability
NOI	Notice of Intent
NPDES	National Pollution Discharge Elimination System
NRHP	National Register of Historic Places
ppmv	parts per million by volume
ROD	Record of Decision
ROI	region of influence
ROW	right-of-way
SHPO	State Historic Preservation Office
U.S.	United States
UIC	Underground Injection Control
USACE	U.S. Army Corps of Engineers
USDW	underground source of drinking water
USEPA	U.S. Environmental Protection Agency

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Summary

INTRODUCTION

The United States (U.S.) Department of Energy (DOE) prepared this Environmental Impact Statement (EIS) to evaluate the potential impacts associated with the proposed FutureGen 2.0 Project. DOE's proposed action would provide financial assistance to the FutureGen Industrial Alliance (the Alliance) for the FutureGen 2.0 Project. DOE is the federal agency responsible for preparation of this EIS, which was prepared pursuant to the National Environmental Policy Act (NEPA) and in compliance with the Council on Environmental Quality (CEQ) implementing regulations (40 Code of Federal Regulations [CFR] 1500-1508) and DOE NEPA implementing procedures (10 CFR 1021). To date, DOE has authorized the expenditure of funds for the purpose of project definition, cost estimating, and preliminary and front-end engineering design activities, and to facilitate environmental review. Such activities do not have an adverse impact on the environment or limit the choice of reasonable alternatives. This EIS will inform DOE's decision of whether to authorize the expenditure of additional funds for final design, construction, and initial operation of the FutureGen 2.0 Project.

FutureGen 2.0 is a public-private partnership with the purpose of developing the world's first large-scale oxy-combustion electric generation project integrated with carbon capture and storage. The FutureGen 2.0 Project replaces the original FutureGen Project (DOE/EIS-0394) as explained in Section 1.2. The FutureGen 2.0 Project consists of two major components: the Oxy-Combustion Large Scale Test and the Carbon Dioxide (CO_2) Pipeline and Storage Reservoir (see Figure S-1). To date, DOE has authorized the expenditure of cost-shared funding to support project definition and planning efforts under Phase I and Phase II. DOE proposes to provide approximately $1 billion of financial assistance to the Alliance that would support preliminary and final design (completion of Phase II), construction and commissioning (Phase III), and operations (Phase IV).

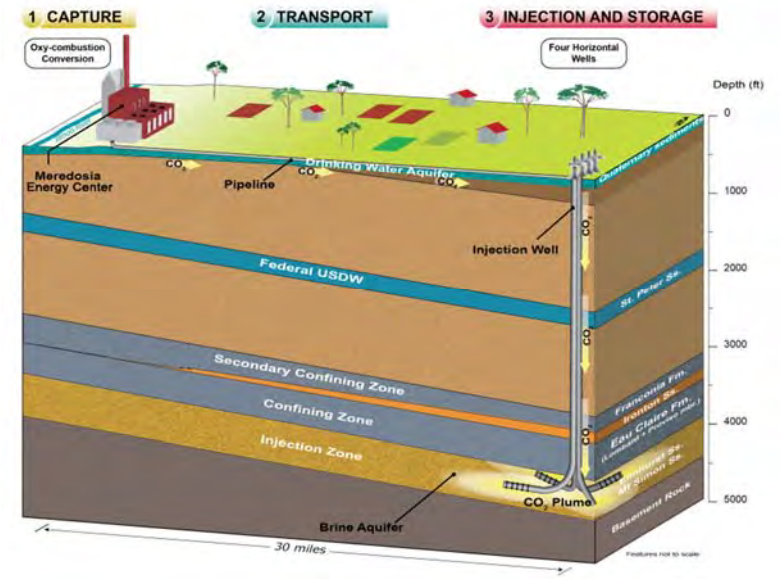


Figure S-1. The FutureGen 2.0 Project

FutureGen 2.0 Project Features

Oxy-Combustion Large Scale Test – Construction and operation of an integrated oxy-combustion coal boiler with CO_2 capture, purification, and compression. Oxy-combustion is the combustion of coal with a mixture of manufactured oxygen and recycled flue gas (instead of air), resulting in a gas by-product that is primarily CO_2.

CO_2 Pipeline – Construction and operation of approximately 30 miles of pipeline to transport CO_2 from the Meredosia Energy Center to a storage reservoir in Morgan County.

Storage Reservoir – Construction and operation of surface facilities and injection and permanent storage of captured CO_2 into a deep geologic formation.

DOE entered into a cooperative agreement with the Alliance under which the Alliance, cooperating with Ameren Energy Resources (Ameren), would upgrade one unit in a power plant currently owned by Ameren near Meredosia, Illinois (see Figure S-2). The repowered unit would include oxy-combustion and carbon capture technologies provided by the Babcock & Wilcox Power Generation Group, Inc. and Air Liquide Process and Construction, Inc. The unit would capture at least 90 percent of its CO_2 emissions **during steady-state**

operation and reduce other emissions to near zero. The captured CO_2 would be transported through a 30-mile pipeline to injection wells where it would be injected deep into a geologic saline formation for permanent storage. The project would be designed to capture, transport, and inject approximately 1.2 million tons (1.1 million metric tons) of CO_2 annually, up to a total of 24 million tons (22 million metric tons) over approximately 20 years. The Alliance would also construct and operate a visitor and research center in addition to training facilities related to carbon capture and storage in the vicinity of Jacksonville, Illinois. The DOE-funded demonstration period would last for 56 months from the start of operations (approximately 2017) through 2022.

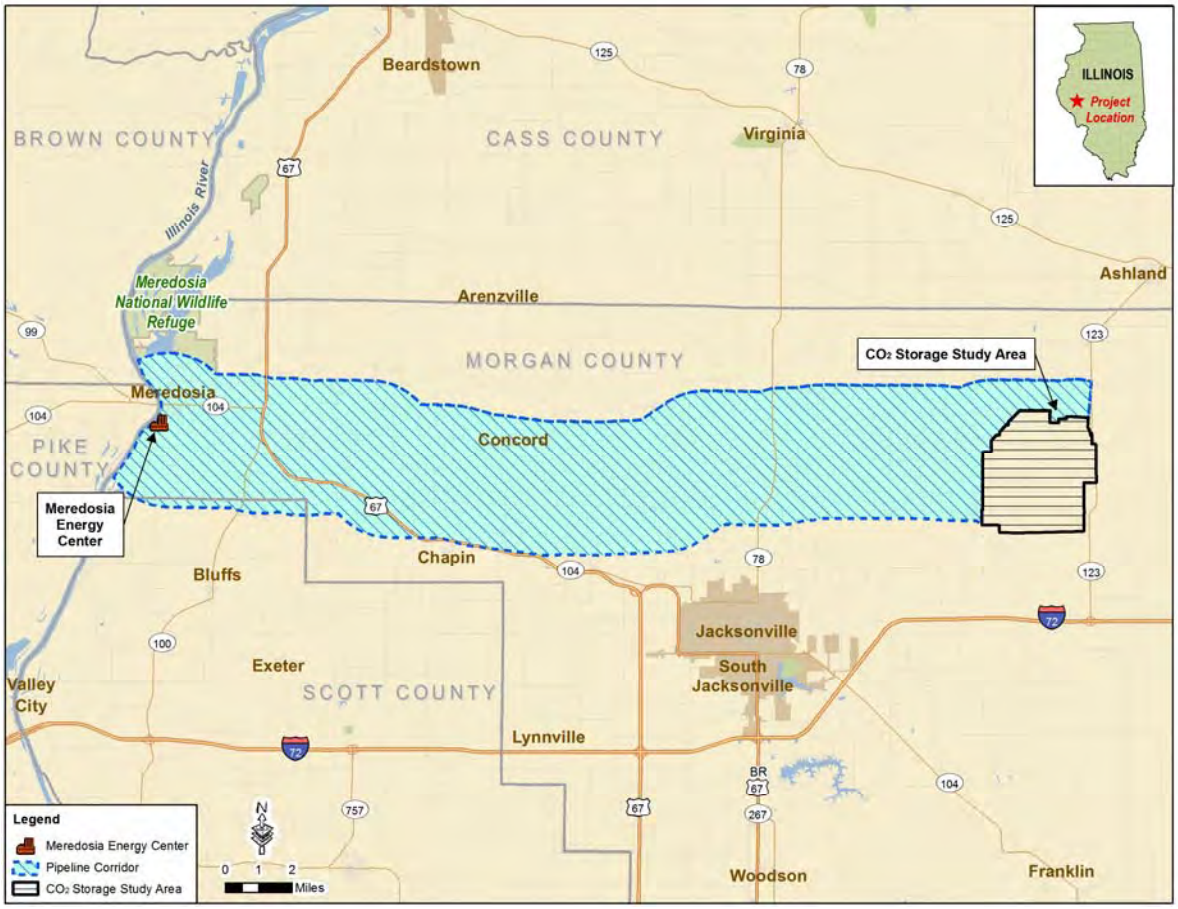


Figure S-2. Project Location Map

The Alliance is a non-profit membership organization created to benefit the public interest and the interests of science through research, development, and demonstration of near-zero emissions coal technology. It was formed to partner with DOE on the FutureGen Initiative, announced by President George W. Bush on February 27, 2003. Members of the Alliance include some of the largest coal producers, coal users, and coal equipment suppliers in the world. The Alliance's current members are: Alpha Natural Resources, Inc.; Anglo American, SA; Joy Global, Inc.; Peabody Energy Corporation; and Xstrata PLC. The active role of industry in this FutureGen Initiative ensures that the public and private sector share the cost and risk of developing the advanced technologies necessary to commercialize the FutureGen concept.

DOE PURPOSE AND NEED

DOE considers the advancement of carbon capture and storage technology critically important to addressing CO_2 emissions and global climate change concerns associated with coal-fueled energy. The purpose of DOE's proposed action is to demonstrate the commercial feasibility of an advanced coal-based energy technology (oxy-combustion) that can serve as a cost-effective approach to implementing carbon capture at new and existing coal-fueled energy facilities. The proposed project would also demonstrate utility-scale integration of transport and permanent storage of captured CO_2 in a deep geologic formation. Implementation of the FutureGen 2.0 Project supports the objectives of the FutureGen Initiative to establish the feasibility and viability of producing electricity from coal with at least 90 percent CO_2 capture **during steady-state operation** and near-zero emissions of air pollutants.

Aging Energy Infrastructure

Nearly half of the electric power generating infrastructure in the United States is more than 30 years old, with a significant portion of this infrastructure having been in service for 60 years or more (EIA 2009b). Substantial refurbishment or replacement of this infrastructure will be required to keep pace with forecasted energy demands. FutureGen 2.0 provides an approach to refurbishment or replacement while addressing CO_2 emissions and global climate change concerns.

One of DOE's primary strategic goals is to protect our national and economic security by promoting a diverse supply and delivery of reliable, affordable, and environmentally sound energy. DOE's action is needed to further this strategic goal with the recognition that coal serves an important role in the nation's energy supply, and that there is growing need to upgrade or replace the nation's aging energy infrastructure. The development of carbon capture and storage technologies through the FutureGen 2.0 Project would demonstrate a viable path forward for the ongoing and future use of the nation's abundant coal reserves in a manner that addresses both aging infrastructure and environmental challenges. Federal financial support is needed to help reduce the risks inherent in these first-of-a-kind projects, which without financial assistance would be unlikely to occur.

DOE PROPOSED ACTION

DOE proposes to provide approximately $1 billion of financial assistance to the Alliance for the FutureGen 2.0 Project. The financial assistance would support final design (Phase II), construction and commissioning (Phase III), and operations (Phase IV). The FutureGen 2.0 Project consists of two major components: the Oxy-Combustion Large Scale Test and the CO_2 Pipeline and Storage Reservoir (see Figure S-1). The proposed action would support the FutureGen 2.0 Project components as summarized in the Description of the FutureGen 2.0 Project, below, and described in detail in Chapter 2, Proposed Action and Alternatives (see Sections 2.1, 2.4, and 2.5).

ALTERNATIVES CONSIDERED BY DOE

Section 102(2)(C) of NEPA (42 United States Code 4332(2)(C)) requires that agencies discuss alternatives to the proposed action in an EIS. The purpose and need for a federal action determines the reasonable alternatives to be analyzed in the NEPA process. Thus, any reasonable alternative to the continued funding of the FutureGen 2.0 Project must be capable of satisfying the underlying purpose and need of the FutureGen Initiative. DOE developed the range of reasonable alternatives for the FutureGen 2.0 Project based on:

- Evaluation of various clean coal technologies through the Clean Coal Power Initiative (CCPI) Program;
- Analysis of the original FutureGen Project in terms of technology, costs, and suitability for geologic storage;

- Data obtained and reviewed through various funding opportunity announcements; and
- Interest of industry to participate in projects to support FutureGen 2.0.

No Action Alternative

Under the no action alternative, DOE would not continue to fund the FutureGen 2.0 Project into the final design, construction, and operation phases. Without DOE funding, it is unlikely that the Alliance, or industry in general, would undertake the utility-scale integration of CO_2 capture and geologic storage with a coal-fueled power plant using oxy-combustion. Therefore, the no action alternative also represents a "no-build" alternative. Without DOE's investment in a utility-scale facility, the development of oxy-combustion repowered plants integrated with CO_2 capture and geologic storage would also occur more slowly or not at all.

Alternatives Dismissed from Further Evaluation

Alternative Fuel Sources

Because the FutureGen Initiative was conceived for the purpose of encouraging commercial development of advanced coal-based carbon capture and storage technologies, other technologies that cannot serve to carry out that goal are not reasonable alternatives. Nuclear power, renewable energy sources (e.g., wind and solar power), and energy conservation improvements do not address the specific goal of reducing CO_2 emissions from coal-fueled energy production and, therefore, are not considered to be reasonable alternatives to FutureGen 2.0. These fuel sources and many others are addressed by other programs and projects in DOE's diverse portfolio of energy research, development, and demonstration efforts.

Alternative Advanced Coal-Based Electric Generating Technologies

Technologies for carbon capture at advanced coal-based electric generating facilities fall into two general categories, pre-combustion and post-combustion. Pre-combustion capture technologies remove carbon from the process stream (fuel gas) after the solid coal feed has been converted (i.e., gasified). Post-combustion capture technologies remove carbon from the process stream (flue gas) after it has been combusted in the boiler. As explained in Section 1.2, the original FutureGen Project considered the demonstration of integrated gasification combined cycle (IGCC) technology for the generation of electricity with pre-combustion capture and storage of CO_2 that would otherwise be emitted. Rising costs for the original project delayed DOE's decision and during the intervening time a number of commercial IGCC projects were proposed, many of which would employ pre-combustion carbon capture technology similar to that which was to be proven by the original FutureGen Project. At the time of award of the FutureGen 2.0 Project, DOE had already awarded funding for four other large-scale projects intended to demonstrate the underlying IGCC concept of the original FutureGen Project.

Due to the now-commercial status of IGCC, along with multiple pre-combustion carbon capture projects within DOE's demonstration portfolio, DOE identified the need for a utility-scale demonstration of post-combustion carbon capture technologies. Accordingly, the agency does not consider pre-combustion technologies to be reasonable alternatives for the FutureGen 2.0 Project.

Alternative Retrofitting Technologies

Through review and consideration of the data and analysis associated with the original FutureGen Project, DOE identified the repowering of an existing power plant with oxy-combustion technology as the approach that would best meet cost and technology advancement objectives of the FutureGen Initiative. Instead of funding the construction and operation of a new IGCC plant, DOE considered two options for retrofitting an existing power plant to facilitate carbon capture and storage: repowering with oxy-combustion technology or post-combustion scrubbing (removal from flue gas). DOE determined that the selection of the oxy-combustion technology for testing and evaluation would complement its CCPI portfolio by providing the opportunity to address a technology option that otherwise would be absent from DOE's slate of projects. Therefore, DOE chose to consider retrofitting an existing power plant with

oxy-combustion technology as a lower-cost replacement for the IGCC process originally proposed in the FutureGen Project. Because DOE is already assessing the merits of post-combustion scrubbing in other projects, the agency does not consider that technology to be a reasonable alternative for the FutureGen 2.0 Project.

Alternative Sites for the Oxy-Combustion Large Scale Test

After determining that construction and operation of a new power plant was not reasonable and building upon the findings in the original FutureGen Final EIS, DOE considered potential power plants in the vicinity of the originally proposed Mattoon CO_2 power plant and storage site as practicable candidates for the FutureGen 2.0 Project. DOE determined that the Meredosia Energy Center had the only available and appropriately sized electrical generating unit that would be suitable for the FutureGen 2.0 Project. Ameren was willing to make its Meredosia Energy Center Unit No. 4 available for the FutureGen Initiative in part because the aging unit was not a baseload power generator and operated only sporadically to provide peaking power. Therefore, repowering efforts at the Meredosia Energy Center would not pose unacceptable disruptions of power generation or affect existing power purchase agreements. It is difficult for owners of existing power plants to accept the financial and operational risks associated with repowering existing equipment and adding untested CO_2 capture and storage to their plants. With no other power plant owners willing to undertake the inherent financial and operational risks, DOE considers the Meredosia Energy Center to be the only viable location for the Oxy-Combustion Large Scale Test component of FutureGen 2.0. DOE does not consider other power plants that are unavailable to the FutureGen 2.0 Project to be reasonable alternatives.

Alternative CO_2 Pipeline and Storage Reservoir Locations

After DOE identified the Meredosia Energy Center for the evolving FutureGen Initiative, the Mattoon site proponents withdrew their site from further consideration based on a determination that use of the site strictly for CO_2 storage was not in the community's best interest. In response to the Mattoon site being withdrawn as a storage site, DOE asked the Alliance to identify alternate storage sites to which it would be economically viable to transport the CO_2 captured at the Meredosia Energy Center for injection and permanent storage in the same geologic formation as proposed for the Mattoon site (the Mt. Simon Formation). The Alliance then undertook a siting process, similar to the original process used to select the Mattoon site, to identify possible locations. The Alliance's siting process included screening sites using specific qualifying criteria related to geologic conditions as well as a variety of other factors, including land use and environmental considerations (see Section 2.5.2.1). This process culminated in the selection of a site in Morgan County as the Alliance's preferred site, with two sites (in Christian County and Douglas County) identified as potential alternate sites.

The Alliance conducted a detailed geological stratigraphic analysis at the preferred Morgan County site to characterize and verify the viability of the proposed CO_2 storage reservoir. The Alliance also conducted pipeline routing studies for the three sites under consideration, as well as desktop and targeted field studies to evaluate sensitive environmental resources that could be adversely affected by the project. Based on the findings of the geological analysis and environmental studies, combined with a cost analysis of the pipelines to the alternate sites, the Alliance confirmed that the proposed Morgan County site remained its preferred site. Through these analyses, the Alliance also determined that the costs of siting, constructing, and operating a CO_2 pipeline to either the Christian County or Douglas County sites would be cost-prohibitive. The Alliance estimated that an additional $50 million to $100 million would be required to construct a pipeline that would be approximately 50 miles (Christian County) or 100 miles (Douglas County) longer than a pipeline required for the Morgan County site.

On July 17, 2012, the Alliance Board of Directors affirmed that the proposed Morgan County site remained its preferred location and voted to direct the Alliance to no longer pursue the sites in Christian County and Douglas County as alternate sites due to cost considerations. The Alliance notified DOE and the proponents of Christian County and Douglas County that their locations were no longer being

considered as alternate sites and that the Alliance would not construct or operate a CO_2 storage reservoir at either site. As a result, the site proponents were released to find other uses for their proposed sites.

Because of the Alliance's decision to no longer consider the Christian County and Douglas County sites, DOE has determined that these sites are not reasonable alternatives as CO_2 storage reservoirs for FutureGen 2.0. Therefore, these sites have been eliminated from further consideration in this EIS.

EIS SCOPING PROCESS

On May 23, 2011, DOE published a Notice of Intent (NOI) to prepare an EIS in the *Federal Register* (FR) under Docket ID No. FR Doc. 2010–12632 (76 FR 29728). The NOI initially identified potential issues and areas of impact that would be addressed in the EIS. After issuing the NOI, DOE conducted three public scoping meetings and consulted with various interested governmental agencies and stakeholders. During the public scoping period, DOE solicited public input to ensure that: (1) significant issues were identified early; (2) issues of minimal significance would not consume excessive time and effort; and (3) the EIS would be thorough and balanced, in accordance with applicable regulations and guidance. DOE held public scoping meetings on the dates indicated at the following locations:

> **EIS Scoping**
>
> EIS scoping is the process by which the scope of issues and alternatives to be examined in the EIS is determined. The process includes soliciting input from the public and consulting with interested governmental agencies and stakeholders, to identify public and agency concerns and significant issues.

- June 7, 2011, at Taylorville High School, Taylorville, Illinois
- June 8, 2011, at Ironhorse Golf Club, Tuscola, Illinois
- June 9, 2011, at the Elks Lodge, Jacksonville, Illinois

The public scoping period ended on June 22, 2011, after a 30-day comment period. During the comment period, DOE accepted comments by telephone, facsimile, U.S. mail, and email.

In general, respondents expressed concerns regarding potential impacts to farmers and farmland (e.g., loss of farmland or impacts to soil). Other concerns included: issues with the experimental nature of the project; a lack of confidence that economic benefits would occur; concerns about the use of public funds for a private endeavor; belief that DOE funding should go toward renewable and alternative energy technologies from sources other than coal; and concerns about potential increased electricity costs for consumers. The majority of issues strictly related to natural resources tended to be general in nature (e.g., potential impacts to surface waters should be addressed). Additionally, two petitions in opposition to the project, signed by a total of approximately 340 residents and landowners in Morgan County, and one petition signed by 55 residents and landowners in Douglas County, were submitted to DOE.

Of the commentors that responded favorably for the project, many commented positively primarily due to economic and job creation benefits for the community, as well as benefits in terms of self-sufficient national energy production.

Following the intent of NEPA, DOE uses the scoping process to focus the analysis of issues and impacts in the EIS. Rather than providing responses to specific comments received during scoping, DOE endeavors to ensure that the EIS addresses and analyzes issues and potential environmental impacts appropriately based on commentor concerns. Chapter 1 (see Table 1-1) provides a summary of the scoping comments received, organized by comment category or applicable resource area, and it identifies the appropriate sections in the EIS where the respective issues are addressed. The subjects and issues raised in specific comments are summarized in more detail in Table 3 of Appendix A, Public Scoping.

DOE also contacted federal and state agencies and Native American tribes during the scoping process to initiate interagency and intergovernmental coordination requirements under various laws. Consultation with the Illinois State Historic Preservation Office (SHPO) resulted in the development of a

Programmatic Agreement signed by DOE, the Alliance, the SHPO, and the Advisory Council on Historic Preservation that outlines steps to address potential discoveries protected by the National Historic Preservation Act **(see Appendix B, Cultural Resources Consultation [B3]).** Consultation with the U.S. Fish and Wildlife Service and the Illinois Department of Natural Resources (IDNR) resulted in the identification of species protected by the Endangered Species Act and by state law to be addressed in the EIS. DOE contacted the U.S. Army Corps of Engineers (USACE) to discuss the potential need for wetland permitting under Sections 10 **and 404** of the Clean Water Act, and contacted the U.S. and Illinois Departments of Agriculture (IDOA) to ensure conformance with the Federal Farmland Protection Policy Act. In compliance with the National Historic Preservation Act, DOE contacted the 18 federally-recognized Native American tribal organizations that could have a cultural or historic affiliation with the area to be affected by the proposed project, based on the National Park Service's listing of tribes to be contacted in conformance with the Native American Graves Protection and Repatriation Act.

COMMENTS RECEIVED ON THE DRAFT EIS

DOE produced the FutureGen 2.0 Draft EIS in April 2013 and published a Notice of Availability (NOA) in the *Federal Register* on May 3, 2013 (78 FR 26004), which is included in Appendix I, Public Comments on the Draft EIS. On the same date, the U.S. Environmental Protection Agency (USEPA) published its NOA for the Draft EIS (78 FR 26027), which initiated the 45-day public comment period (from May 3 to June 17, 2013).

On May 21, 2013, DOE held a public hearing on the Draft EIS for the FutureGen 2.0 Project at Jacksonville High School, Jacksonville, Illinois. An informational session was held from 5:00 p.m. to 6:00 p.m., followed by the formal presentations and comment period from 6:00 p.m. to approximately 8:00 p.m. Appendix I, Public Comments on the Draft EIS, provides a summary of the public hearing and commenting period.

In addition to the notice of the hearing in the NOA, DOE posted notices in three area newspapers (Jacksonville *Journal-Courier*, Springfield *State Journal-Register*, and Illinois *Farm Week*) during the three weeks prior to the public hearing that announced the hearing date, time, location, and purpose. DOE also distributed notifications for the public hearing on April 26, 2013, including 147 letters each with a hardcopy of the Draft EIS, 164 notification letters alone, and 180 notifications by email.

A total of 46 people signed attendance sheets for the public hearing, and seven individuals signed up to give oral comments. During the informational session, the public was invited to view various displays about the NEPA process and the FutureGen 2.0 Project and to talk with DOE and Alliance representatives. During the formal hearing, presentations were made by the DOE Document Manager and the Alliance's Chief Executive, and the floor was opened for public comments. A court reporter recorded the formal presentations and oral comments as documented in the transcript included in Appendix I, Public Comments on the Draft EIS.

DOE received comments from two federal agencies, two state agencies, one local elected official, four non-governmental or public-private organizations, and seven members of the public during the official 45-day comment period, including the oral comments at the hearing. The comments are catalogued according to the specific comments by each respective commentor in Appendix I, Public Comments on the Draft EIS, along with DOE's response to each comment. In aggregate, a total of 116 comments were received in 19 separate submissions from 16 individuals (1 member of the public spoke at the hearing and also submitted 3 sets of written comments). In preparing the Final EIS, DOE fully considered all comments both individually and cumulatively, including comments received after the closing date.

The largest proportion of comments related to the adequacy of information provided about the project and potential impacts. The majority of resource-specific comments focused on

socioeconomic issues, geology, and climate and greenhouse gas emissions. Another substantial group of comments was distributed relatively evenly among concerns about health and safety, biological resources, NEPA requirements, and air quality. The remaining group of comments was distributed among other subject areas: alternatives, land use, purpose and need, cumulative impacts, environmental justice, regulatory issues, surface water, wetlands, groundwater, physiography and soils, and utilities.

Comments about the adequacy of information in the Draft EIS expressed dissatisfaction with the level of detail provided about the project and engineering features, alleged that the Alliance withheld or provided inconsistent information, questioned the Alliance's qualifications to complete the project, claimed that the Draft EIS did not provide adequate information about financial assurances and monitoring for the geologic CO_2 storage component, or alleged other deficiencies in project information.

Several comments on socioeconomic issues expressed support for the project based on the potential for economic stimulus and other benefits. Other socioeconomic comments expressed concerns about potential cost overruns and the adverse impacts on taxpayers and ratepayers. Additional comments questioned whether the project would be justified by a full cost-benefit analysis, expressed concerns about economic risks, or questioned whether economic benefits would be realized.

Geology-related comments expressed concerns about whether selection of the CO_2 storage area was justified, whether the geologic storage formation could adequately support the project, whether the caprock formation could withstand the chemical effects of CO_2 injection, and similar issues.

Comments on climate and greenhouse gases included some that questioned whether the project would in fact reduce greenhouse gas emissions, questioned the validity of climate change, or expressed concerns about other greenhouse gas issues. Other comments expressed support for the project based on potential reductions in emissions from fossil fuel combustion.

The balance of comments addressed other subjects, including potential health and safety risks associated with leakage from the CO_2 storage formation or the pipeline, mitigation for potential biological resource impacts, concerns about DOE's implementation of NEPA, claims that the purpose and need or consideration of alternatives were not adequately addressed, or concerns about potential impacts on other resources.

PRINCIPAL CHANGES BETWEEN THE DRAFT AND FINAL EIS

The Draft EIS primarily analyzed the Alliance's initial design for the FutureGen 2.0 Project. Throughout DOE's NEPA process, the Alliance continued to develop its conceptual and preliminary designs for the oxy-combustion facility, CO_2 pipeline, injection wells and associated surface facilities for permanent geologic CO_2 storage, and educational facilities. The Final EIS reflects the changes made as more information became available, including: (a) project design changes, (b) studies not completed in time to be included in the Draft EIS, and (c) recent regulatory developments. DOE also revised and updated the Final EIS as appropriate in response to comments received on the Draft EIS as discussed above.

Table S-1 (new in the Final EIS) summarizes the principal changes in the project between the Draft and Final EIS and explains how these changes affected respective sections in the Final EIS. The additions to this Final EIS reflecting substantive changes from the Draft EIS are shown in the same text format as displayed in this paragraph (i.e., new inserted text appears in bold type accompanied by a bar in the margin; deletions are not shown, and minor editorial changes are not marked.

Changes from Draft to Final EIS

Additions to this Final EIS reflecting substantive changes from the Draft EIS are shown in bold type accompanied by a bar in the margin; deletions are not shown, and minor editorial changes are not marked.

Table S-1. Principal Changes from the Draft to the Final EIS

Project Feature	Change	Basis and Description of Change	Section(s) of EIS Affected
FutureGen 2.0 Project			
	Project design updates	**Throughout DOE's NEPA process, the Alliance continued to develop its conceptual and preliminary designs for the energy center, pipeline, and injection wells for permanent geologic CO_2 storage. In February 2013, the Alliance entered Phase II of the project for completion of front-end engineering and design. The Final EIS reflects the changes that have been made to the project design since release of the Draft EIS.**	**DOE updated all sections of the EIS and appropriate appendices to reflect new design details for the proposed project. For some resources, DOE maintains the impact analyses from the original project design analyzed in the Draft EIS as upper-bound scenarios.**
	New or additional information provided based on efforts completed since publication of Draft EIS	**In addition to the refinements in the conceptual and preliminary design, DOE and the Alliance performed associated studies and field work that provided new or updated data for consideration in the Final EIS.**	**DOE updated all sections of the EIS and appropriate appendices to include the new or updated information made available since publication of the Draft EIS.**
	Public hearing held on the Draft EIS and comments received	**Agency and public comments on the Draft EIS directed the need for updates or changes to the Final EIS.**	**DOE added Appendix I, which includes the summary of the public hearing, comments received, DOE responses, and the Notice of Availability of the Draft EIS. Section 1.6.3 was added to Chapter 1 summarizing the public hearing and comments received; this information was also added to this Summary. Text throughout the Final EIS was updated where appropriate to reflect responses to comments.**
Oxy-Combustion Facility at the Meredosia Energy Center			
	Reduction in impacted area at the Meredosia Energy Center	**The need by Ameren Transmission Company to use portions of the energy center property for the separate Illinois River Transmission Line project, as well as consultation with the USFWS and comments received from the USDOI, resulted in reevaluation of the site layout to reduce the amount of forested land that could potentially be impacted by the oxy-combustion facility at the energy center.**	**DOE added Figure 2-15 to Chapter 2 to present the revised impact areas at the energy center, reducing the forested impact acreage from approximately 33 acres (analyzed in the Draft EIS) to approximately 9 acres. The Final EIS analyzes impacts from this reduced impact scenario, while also maintaining the impact analysis from the Draft EIS as an upper-bound scenario. DOE has made associated updates to Sections 2.4.3; 3.3 Physiography and Soils; 3.6 Surface Water; 3.7 Wetlands and Floodplains; 3.8 Biological Resources; and 3.10 Land Use.**

Table S-1. Principal Changes from the Draft to the Final EIS

Project Feature	Change	Basis and Description of Change	Section(s) of EIS Affected
Oxy-Combustion Facility at the Meredosia Energy Center *(continued)*			
	Changes to process materials and waste quantities, and changes to coal delivery options.	**Refinements in the project design since publication of the Draft EIS resulted in an increase in input rates for coal, hydrated lime, trona, and the generation rate of bottom ash, along with the daily and yearly truck and barge trips. Also, the Alliance is now considering an option for offsite blending of the two coal types at an existing commercial coal handling facility in St. Louis, instead of the current plan for onsite blending. This option would reduce truck traffic but require additional barge deliveries.**	**DOE updated Sections 2.4.4.1 and 2.4.4.2 to reflect the changes in process materials and waste, as well as Section 3.12, Materials and Waste Management. Section 3.13, Traffic and Transportation, was updated to discuss the option for offsite blending and the resultant change in truck and barge traffic.**
	Air quality analysis updates to reflect 168 MWe design.	**The FutureGen 2.0 designers initially calculated emissions for the oxy-combustion facility based on a proposed generating capacity of 200 MWe. Estimated emissions based on these calculations were reported in the construction permit application to the IEPA in February 2012. While the Draft EIS was being prepared, the Alliance decided to reduce the planned generating capacity to 168 MWe, and DOE analyzed all other resources in the Draft EIS based on the revised capacity of 168 MWe. But the air quality analysis in the Draft EIS was based on a 200 MWe capacity because a revised construction permit application had not yet been submitted for the lower capacity. Since publication of the Draft EIS, the Alliance prepared and submitted a revised construction permit application in June 2013 to reflect the 168 MWe capacity.**	**DOE updated Section 3.1, Air Quality, to present estimated air emissions based on the 168 MWe design, as well as updated analyses contained in the revised construction permit application. As explained, the impacts analyses for other resources in the Draft EIS were already based on the 168 MWe design.**
	Increase in river water usage.	**Ongoing design efforts increased the river water usage rate from 11.4 to 13.6 million gallons per day for the oxy-combustion facility.**	**DOE revised Section 2.4.4.1 and Section 3.6, Surface Water, to reflect the increase in water usage.**
CO_2 Pipeline			
	The pipeline corridor was reduced in size.	**Due to developments in pore space acquisitions, the Alliance expanded the CO_2 storage study area (see below for further discussion). This expansion caused a reduction in the CO_2 pipeline corridor acreage.**	**DOE updated Figure 2-17 to show the revised CO_2 pipeline corridor. All resource sections that describe characteristics of the corridor were updated as appropriate.**
	The Alliance selected the southern pipeline route as the proposed	**Since publication of the Draft EIS, the Alliance selected the proposed location for the injection wells. Thus the proposed alignment of the southern pipeline route was**	**DOE revised Section 2.5.1 to explain the changes to the southern pipeline route. Updates were made to all figures in the EIS**

Table S-1. Principal Changes from the Draft to the Final EIS

Project Feature	Change	Basis and Description of Change	Section(s) of EIS Affected
CO_2 Pipeline *(continued)*			
	route and further defined the alignment.	**extended within the CO_2 storage study area to the injection well site. After extensive field work and coordination with landowners and federal and state agencies (i.e., Illinois SHPO, the IDNR, and the USACE), the Alliance further defined the most likely pipeline route. The route was selected based on coordination with landowners and consideration of constructability, access to existing ROWs, and the desire to avoid, to the extent possible, sensitive environmental resources such as wetlands, cultural resources, forest land, and threatened or endangered species and their habitats.**	**that depict the pipeline routes. All resource sections that describe impacts along the southern pipeline route were updated as appropriate.** **Since the Alliance does not plan to move forward with the northern pipeline route, final routing within the storage study area was not identified for the northern route to the injection wells. As a result, DOE addresses the pipeline impacts for the northern route based on the analysis presented in the Draft EIS using hypothetical end-of-pipeline spurs.** **The depicted southern pipeline route could ultimately deviate as a result of final project design and coordination with landowners; however, the Alliance would follow the same siting criteria and impacts would be consistent with those addressed in this EIS, as described in updated Section 3.0.**
Injection Well Site			
	The Alliance selected a location for the injection well site.	**Since publication of the Draft EIS, the Alliance selected a location for the injection well site and submitted UIC Class VI permit applications to the USEPA for the injection wells. The construction of injection wells cannot begin until the UIC permits are issued. In the Draft EIS, DOE analyzed hypothetical injection well sites and pipeline spurs to represent a range of potential impacts in the Draft EIS. In the Final EIS, DOE analyzes impacts related to the recently proposed injection well site location.**	**DOE revised Section 2.5.2 to explain the selection of the injection well site and updates to the design and impacts of the horizontal injection wells. Updates were made to all figures in the EIS that depict the injection wells. All resource sections that analyze impacts at the injection well site were updated. DOE updated Sections 3.4, Geology, and 3.17, Human Health and Safety, to reflect recent data included in the UIC permit applications.**
	The CO_2 storage study area was expanded.	**Since publication of the Draft EIS, the Alliance has been working with local landowners to acquire additional pore space rights to ensure that the CO_2 plume would not affect subsurface rights of non-participating landowners. As a result of these efforts, the size of the CO_2 storage study area has been expanded to 6,800 acres with the additional 1,500 acres**	**DOE revised Section 2.5.2 to explain the expanded CO_2 storage study area and associated reduction in the pipeline corridor acreage. Updates were made to all figures in the EIS that depict the CO_2 storage study area. All resource sections that analyze impacts at the CO_2 storage study area were updated.**

Table S-1. Principal Changes from the Draft to the Final EIS

Project Feature	Change	Basis and Description of Change	Section(s) of EIS Affected
Injection Well Site *(continued)*			
		located south and west of the original study area boundary. While the location of the CO_2 plume has shifted south slightly as a result of availability of additional pore space and the Alliance's plan to construct and operate four horizontal injection wells of varying lengths, the subsurface plume extent would remain as estimated in the Draft EIS; approximately 4,000 acres.	
	Design changes to the injection well site configuration.	**The proposed injection well site would include four horizontal injection wells on one well pad, the site control and maintenance building, parking area, sidewalks, and other infrastructure (stormwater basin, a packaged wastewater treatment system, screening berms, and fencing). The configuration of the injection well site would be dependent on the design scenario – single-site or dual-site scenario. Since the Alliance selected the single-site scenario with four horizontal injection wells as its preferred option, additional details about this injection well site configuration were made available for the Final EIS. The principal changes include the following:** • **Buildings. The Draft EIS included both a single-site scenario with four horizontal injection wells at one well pad; and a dual-site scenario with one vertical injection well and one well pad at each of two different sites. The new design details specified that the single-site scenario would require only one building to house the surface facilities, as opposed to the dual-site scenario that would require as many as four buildings distributed between two sites.** • **Size of Site. In the Draft EIS, the land area impacted by the injection well site(s) reflected the dual-site scenario, as it was more conservative, and the single-site scenario was in very preliminary design. Since publication of the Draft EIS, the Alliance chose a location for the single injection well site and furthered its conceptual design, resulting in a reduction in acreage of**	**DOE revised Sections 2.5.2.2 through 2.5.2.4 to explain the changes to the design of the injection well site for the single-site scenario. Updates were made to all figures in the EIS that depict the injection and monitoring wells, surface facilities, and infrastructure. All resource sections that analyze impacts at the injection well site were updated.** **DOE has updated the impact analyses in the Final EIS to discuss impacts resulting from the single-site scenario, while maintaining the dual-site impact analysis as presented in the Draft EIS to serve as a more conservative upper bound.**

Table S-1. Principal Changes from the Draft to the Final EIS

Project Feature	Change	Basis and Description of Change	Section(s) of EIS Affected
Injection Well Site *(continued)*			
		impact areas compared to the dual-site scenario. Additionally, the length and acreage required for access roads would be less for the single-site scenario compared to the dual-site scenario. • **Monitoring Well Network. Since publication of the Draft EIS, the Alliance updated details regarding the monitoring well network for the single-site scenario.**	
Educational Facilities			
	Design changes to the educational facilities configuration.	**Since publication of the Draft EIS, the Alliance modified its plans such that the current conceptual design assumes that the visitor, research, and training facilities would be housed in a single building, rather than two separate buildings. However, since design concepts are still in development, the Final EIS maintains the impact analyses in the Draft EIS, based on the original conceptual design for multiple educational buildings, as representing a conservative upper bound for potential impacts.**	**DOE revised Section 2.5.3 to explain changes to the design of the educational facilities. All resource sections that analyze impacts at the educational facilities were updated.**

CO_2 = carbon dioxide; DOE = U.S. Department of Energy; EIS = Environmental Impact Statement; IDNR = Illinois Department of Natural Resources; IEPA = Illinois Environmental Protection Agency; MWe = megawatt electrical; NEPA = National Environmental Policy Act; ROW = right-of-way; SHPO = State Historic Preservation Office; UIC = Underground Injection Control; USACE = U.S. Army Corps of Engineers; USDOI = United States Department of the Interior; USEPA = United States Environmental Protection Agency; USFWS = United States Fish and Wildlife Service

DESCRIPTION OF THE FUTUREGEN 2.0 PROJECT

For the FutureGen 2.0 Project, the Alliance would purchase from Ameren the assets of the Meredosia Energy Center that would be needed for the Oxy-Combustion Large Scale Test component of the proposed project. Ameren suspended plant operations at the end of 2011 but has retained the permits associated with the facility and will maintain the facilities to be available for the FutureGen 2.0 Project. All equipment remains in operable condition, which would enable Ameren to operate the generating facilities if the resumption of operations were to fit Ameren's requirements. If the FutureGen 2.0 Project is implemented, Ameren would permanently terminate operations of the existing boilers and related power generation infrastructure.

With support from Babcock & Wilcox and Air Liquide, the Alliance would design, construct, and operate an advanced oxy-combustion power generation plant. The oxy-combustion project has a proposed design capacity of 168 megawatt electrical (MWe) (gross) and would be integrated into the Meredosia Energy Center in order to make use of existing facilities and infrastructure. The facility would operate continuously to generate baseload electric power. The project would repower the existing Unit 4 steam turbine generator and capture and compress approximately 1.2 million tons (1.1 million metric tons) of CO_2 per year for subsequent transport and geologic storage. The project would be designed to meet DOE's CO_2 capture target of at least 90 percent (the project **may achieve a** 98 percent **capture efficiency**) **during steady-state operation** while reducing emissions levels of sulfur oxides**, carbon monoxide,** nitrogen oxides, mercury, acid gases, and particulate matter during normal operations.

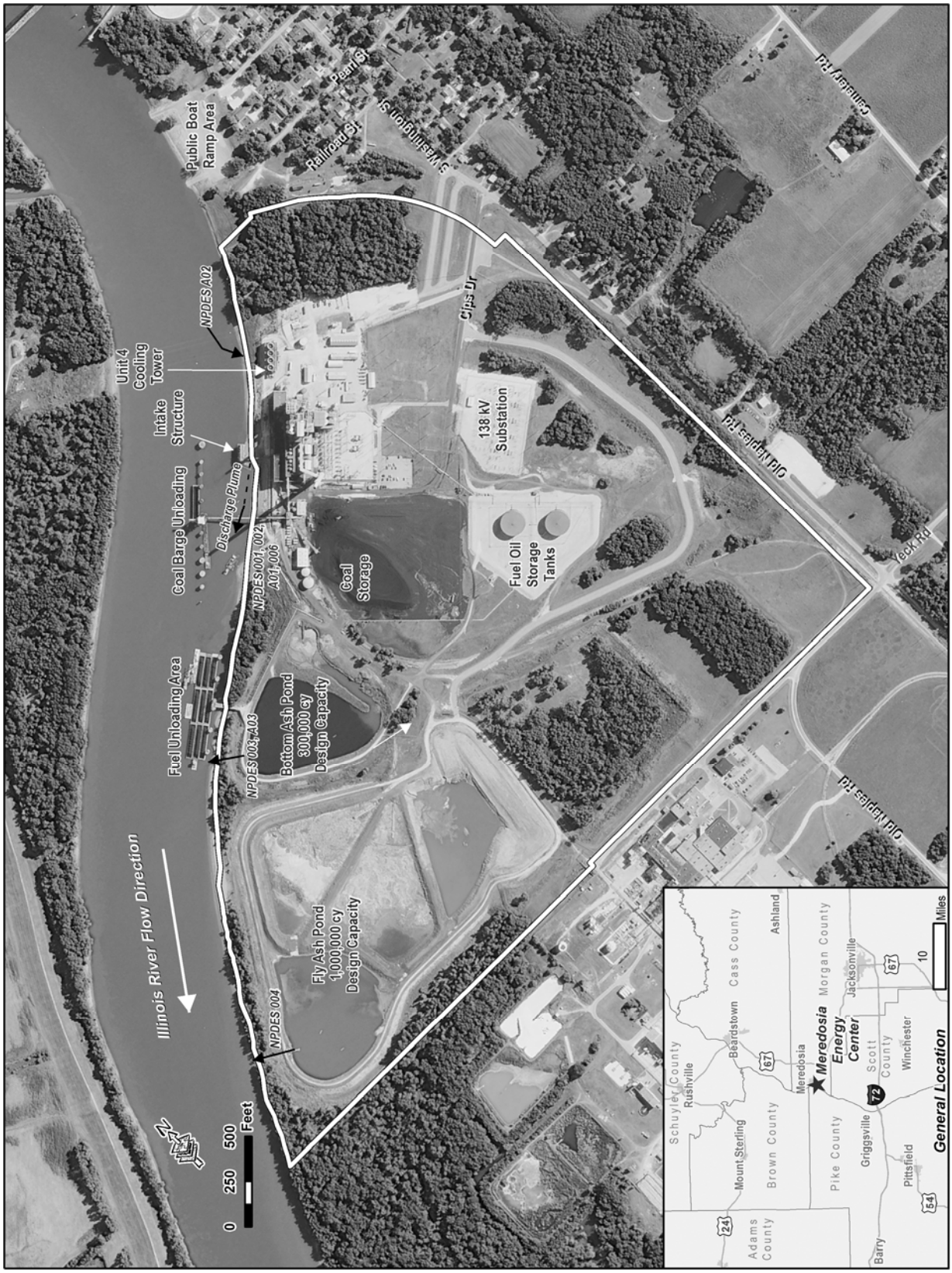
The Meredosia Energy Center

The Meredosia Energy Center, shown in Figure S-3, is located adjacent to the east side of the Illinois River, south of the village of Meredosia, Illinois. The 5,300-foot western boundary of the 263-acre energy center fronts the Illinois River, where the station's oil and coal barge unloading facilities are located (see Figure S-4). The energy center includes the infrastructure necessary to support the operation of a power generation plant including material and fuel handling and delivery facilities, process water sources, intake structures and treatment systems, stormwater and wastewater systems, cooling systems, and interconnects to high voltage transmission lines.

Figure S-3. Meredosia Energy Center

The Meredosia Energy Center includes four electric generating units (see Figure S-5). An electric generating unit refers to the combination, or unit, of equipment used to generate electricity including the boilers that create heat energy through combustion, steam cycle equipment that uses the heat to generate steam, steam turbines that convert the steam to mechanical energy, and electric generators that convert the mechanical energy to electricity. These units also include supporting equipment and facilities. Units 1 and 2 consist of four coal-fired boilers (Boilers 1, 2, 3, and 4), with each unit having a nominal rated generating capacity (i.e., capacity) of 60 MWe. Unit 3 consists of one coal-fired boiler (Boiler 5) and has a capacity of 229 MWe.

Unit 4 consists of one oil-fired boiler (Boiler 6) with a capacity of 200 MWe. Unit 4 was placed in service as an interim measure in 1975 to meet anticipated load growth until new generating facilities came online in 1977. During the 1980s and early 1990s, Unit 4 was operated as a peaking unit, accumulating approximately 20,000 hours of operation, with 900 starts. Peaking units are electric generating units that are only used during periods of high electricity demand.



cy = cubic yard; kV = kilovolt; NPDES = National Pollutant Discharge Elimination System

Figure S-4. Meredosia Energy Center Features – Aerial Overview