EXHIBIT NO._____

BEFORE

THE PUBLIC UTILITIES COMMISSION OF OHIO

In the Matter of the Application of Columbus Southern Power Company and Ohio Power Company for Authority to Recover Costs Associated With Construction and Ultimate Operation of an Integrated Gasification Combined Cycle Electric Generating Facility	))))))	Case No. 05-376-EL-UNC

DIRECT TESTIMONY OF DANIEL M. DUELLMAN ON BEHALF OF OHIO POWER COMPANY

Filed: October 23, 2014

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DANIEL M. DUELLMAN

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BEFORE
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DIRECT TESTIMONY OF
DANIEL M. DUELLMAN
ON BEHALF OF
OHIO POWER COMPANY

PERSONAL DATA

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Daniel M. Duellman. My business address is 1 Riverside Plaza, Columbus, Ohio, 43215.

Q. BY WHOM ARE YOU EMPLOYED AND WHAT IS YOUR POSITION?

A. I am employed by American Electric Power Service Corporation (AEPSC) as Director – New Generation Engineering. AEPSC is a subsidiary of American Electric Power Company, Inc. ("AEP"), and provides professional services to AEP's operating companies, which includes Ohio Power Company ("AEP Ohio" or the "Company").

Q. PLEASE DESCRIBE YOUR EDUCATIONAL AND PROFESSIONAL BACKGROUND.

A. I graduated from The Ohio State University with a Bachelor of Science degree in Mechanical Engineering in 1980. I completed the The Ohio State University, Fisher College of Business, Management Development Program in 1995, and I completed the Management Development Program at Virginia Polytechnic Institute in 1997. I am a past member of the American Society of Mechanical Engineers Code Enforcement Committee from 1985 to 1990 and a board member of the Pittsburgh Coal Conference Committee. I have been a registered professional engineer in the State of Ohio since 1985.

I have over 30 years of professional experience in the design, construction, operation and maintenance of coal and gas-fired power plants. Most of my career has been spent in the AEP system, including subsidiaries of AEP. From starting as a co-op student in 1979, to moving to the Big Sandy Power Plant (owned by an AEP Ohio affiliate) in 1989, to heading up AEP's Northern Regional Services Organization, and later managing the AEP Selective Catalytic Reduction retrofit program, I have held varying engineering and managerial roles of increasing responsibility throughout my career with AEP.

In 2004, I worked for Washington Group International as project director. My responsibilities included routine outage execution and the technology selection and construction of Detroit Edison's environmental retrofit programs.

I returned to AEP in 2005 to accept a position as the engineering manager in the newly formed group assigned to the engineering and construction of new generation power plant projects, specifically the integrated gasification combined cycle (IGCC) project. During that time, I was also responsible for the development of estimates and proposals for simple and combined cycle gas-fired plants, coal fired plants for the AEP system. This included proposals and estimates for the construction of IGCC facilities, including the project that is the focus of this proceeding. In 2008, I accepted my current position of Director – New Generation Engineering.

Q. WHAT ARE YOUR RESPONSIBILITIES AS DIRECTOR – NEW GENERATION ENGINEERING?

A. I am responsible for all of AEP's new generation power plant projects. In total, my current responsibilities include the engineering support for a recently-completed coal-fired power plant built by an AEP Ohio affiliate, simple and combined cycle natural gas power plant

projects, IGCC projects, and AEP's carbon dioxide capture and storage project. In addition to these project responsibilities, my department is also responsible for the monitoring and evaluation of new generation and advanced emission control technologies and the engineering and construction of various emission control retrofit projects.

Q. HAVE YOU PREVIOUSLY SUBMITTED TESTIMONY IN ANY REGULATORY PROCEEDINGS?

A. Yes. I testified on behalf of Southwestern Electric Power (another of AEP's operating companies) before the Arkansas Public Service Commission in Docket No. 08-006-P.

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?

A. The purpose of my testimony in this proceeding is to describe the costs incurred by AEP Ohio (which included both Ohio Power Company (OPCo) and Columbus Southern Power Company (CSP) at the time the costs were incurred)[1] that were associated with the activities necessary to engineer, design, and estimate the total cost for a proposed IGCC generating facility to be constructed at the Great Bend site in Meigs County, Ohio (the "Great Bend IGCC"). These activities are referred to as the "Phase I" activities.

First, I will provide a brief overview of IGCC generation technology. I will also describe the activities that were performed during Phase I of the Great Bend IGCC project, including the scoping and Front-End Engineering and Design (FEED) processes. Next, I will support the reasonableness of the costs incurred to perform those Phase I activities and explain how those costs were assigned or allocated to the three IGCC projects within the AEP system. I also explain that, other than the common costs that have already been

[1] CSP and OPCo merged effective December 31, 2011, with OPCo remaining as the surviving entity.

allocated to IGCC projects undertaken by AEP Ohio affiliates, there are no expenditures for the Great Bend IGCC project that are associated with items that may be utilized at other sites.

Q. ARE YOU SPONSORING ANY EXHIBITS WITH YOUR TESTIMONY?

A. Yes. I am sponsoring three Exhibits.

- Exhibit DMD-1: A Summary of AEP Ohio's Great Bend IGCC Phase I Costs
- Exhibit DMD-2: Non-AEP FEED Study Cost Documentation
- Exhibit DMD-3: Timeline of All IGCC Projects, including the AEP Ohio Great Bend IGCC Project

IGCC GENERATION TECHNOLOGY

Q. WHAT IS MEANT BY THE TERM "IGCC"?

A. IGCC refers to a power generation technology where coal is first converted to gas (syngas), then cleaned, and subsequently burned in a combustion gas turbine/combined cycle system. The Company was studying this generation technology for deployment in lieu of a more traditional and common plant design, where coal is combusted using air and the heat from that combustion is used to generate steam and drive a steam turbine.

In the IGCC process, coal is initially gasified, cleaned, and combusted as a gas, rather than directly combusted as a solid fuel. IGCC technology offers advantages over pulverized coal generation, in that the volume of gas produced by the gasifier is small compared to the gas produced from a coal-fired boiler. And, the gas is cleaned prior to combustion rather than after combustion, resulting in a significantly smaller volume of gas that must be cleaned. IGCC plants are efficient due to the incorporation of the most

recent developments in combined cycle generation technology, which employs gas and steam turbines to extract as much energy from the fuel as possible.

Beyond the advantages of combined cycle efficiency and effectiveness of pollutant removal, IGCC technology can more easily and inexpensively be retrofitted with equipment for the capture of carbon dioxide (CO_2) from the process. Just as is the case today, in 2005 AEP anticipated that carbon emissions from power plants would be regulated, and if CO_2 capture is required IGCC has a decided cost advantage over pulverized coal.

Overall, IGCC is a process that is much more akin to a chemical plant than the typical process used to generate electricity from coal. This advanced technology did, and still does, hold promise for the generation of electricity. While the costs of IGCC projects currently under construction in the United States have risen significantly from AEP's early estimates, the technology is still believed to hold promise as a clean and efficient way to generate electricity from coal while also limiting CO_2 emissions.

Q. IS AEP CURRENTLY PURSUING THE CONSTRUCTION OF ANY IGCC FACILITIES?

A. No. While AEP continues to be supportive of the optimization of the technology, much has changed since 2005. The economic crisis in 2007 and 2008 led to an abrupt reduction in demand for electric generation, which has been followed by a reduction in growth of electric sales in many parts of the United States. This reduction in growth has reduced the need for large, new, baseload generating facilities. Also since 2005, the advent of abundant and inexpensive shale gas has dramatically decreased the cost of natural gas as a fuel for power generation in the United States. In fact, during 2005, spot

natural gas prices reached some of their highest levels in recent history, peaking at over $13 per million British Thermal Unit (MBtu) late that year. August 2014 prices for gas were $3.91 per MBtu, by comparison.[2] The stark contrast between these two values shows why in 2005 interest in IGCC generating technology was so much greater than it is today and why natural gas-fired generation has proliferated so much in the last half decade.

GREAT BEND IGCC STUDY ACTIVITIES

Q. WHEN YOU DESCRIBE PHASE I ACTIVITIES RELATED TO THE GREAT BEND IGCC, TO WHAT ACTIVITIES ARE YOU REFERRING?

A. The activities that I discuss in my testimony all relate to the preconstruction evaluation, engineering, and design of the Great Bend IGCC facility, which during the time frame of the Company's initial filing in this proceeding - 2005 - was intended for future construction assuming the Phase I activities confirmed the feasibility of completing the project. As is typical with the design and construction of a project as large and complex as a power generation facility, the project was planned to occur in multiple distinct phases. At the time the Great Bend IGCC facility was in the planning phases, the project was envisioned to occur in three phases, with Phase I of the project including the initial feasibility study, a scoping study, a Front End Engineering and Design (FEED) Study, and other work that is necessary to finalize the design and cost estimate of the completed facility. Phase II of the project would subsequently begin with the Company entering into an Engineering, Procurement, and Construction (EPC) contract with a third party for the actual detailed

[2] U.S. Energy Information Administration, Henry Hub Natural Gas Spot Prices, *available at* http://www.eia.gov/dnav/ng/hist/rngwhhdm.htm.

engineering, procurement, construction, and start-up of the facility. Phase III would cover the operating life of the completed facility.

All of the costs and activities that I discuss in this testimony are associated with Phase I of the project and were incurred to study, design, and estimate the cost of the completed Great Bend IGCC facility.

Q. PLEASE DESCRIBE THE FEASIBILITY STUDY THAT WAS PERFORMED FOR THE GREAT BEND IGCC PROJECT.

A. The feasibility study that was performed for the Great Bend IGCC Project was used to determine whether or not it was reasonable for the Company to further pursue the construction of an IGCC generating facility. The feasibility study consisted of the creation of a conceptual scope and a high level project cost estimate of the IGCC technology. Based on the work performed, all indications were that it was a worthwhile endeavor to further pursue a more detailed study of an IGCC facility.

The results of the feasibility study were reflected in a white paper that was included as an exhibit to the testimonies of Michael J. Mudd and Bruce H. Braine in the Company's initial filing in this proceeding (BHB/MJM Exhibit 1). This white paper generally described IGCC technology, and provided the economic comparisons of IGCC versus other competing generation technologies.

Q. WHAT ACTIONS DID THE COMPANY THEN PERFORM TO FURTHER THE STUDY OF AN IGCC FACILITY?

A. As stated in the direct testimony of Company witness William M. Jasper, filed on May 5, 2005 in this proceeding, AEPSC entered into an agreement with General Electric (GE) and Bechtel (the "GE/Bechtel Alliance") to conduct a scoping study for the Great Bend IGCC

facility. The scoping study had numerous deliverables, including a basic definition of the configuration of the proposed IGCC facility, a defined scope of work for each of the companies involved in the work, a high level project schedule, and an indicative cost estimate.

And, while AEPSC hired the GE/Bechtel Alliance to perform much of the process design work associated with the facility, a significant amount of the scope was also kept in-house in order to use AEPSC's own engineering knowledge and skill to perform those aspects of the project that fall into AEPSC's area of expertise. The aspects of the project that were engineered in-house at AEPSC were the fuel and material unloading and handling systems, the switchyard and transmission interconnection, the river frontage improvements, landfill design, and general site development.

With responsibility for the major subparts of the projects defined, discrete points of interface between AEPSC scope of work and the GE/Bechtel scope of work were identified so that each party was aware of their defined tasks, responsibilities and activities. And, with the completion of each of the subparts of the project, AEP Ohio then collected all of the necessary information from GE/Bechtel, as well as internal and external engineering groups, to arrive at an all-inclusive cost estimate for the entire generating facility.

Q. WHAT ACTIVITIES WERE THEN PERFORMED TO ARRIVE AT AN ALL-INCLUSIVE COST ESTIMATE FOR THE CONSTRUCTION OF THE FACILITY?

A. The process of creating an all-inclusive cost estimate is more involved than taking each of the costs for each of the project subparts and adding them together. AEP Ohio performed detailed reviews of the scope of work that had already been performed to ensure that there

were no gaps in the work performed by the various organizations and companies that provided input into the design.

Once this work was complete, AEP Ohio then took the total of the individual costs and applied corporate overheads, financing costs, and escalations to reflect the time over which an EPC contract would occur, to arrive at an estimated total project cost.

GREAT BEND IGCC PHASE I COSTS

Q. WHAT WAS THE TOTAL COST ASSOCIATED WITH THE GREAT BEND IGCC PHASE I ACTIVITIES?

A. The initial determination of the total costs associated with the Great Bend IGCC Phase I activities, prior to audit, was $21.074 million. A more detailed breakdown of this cost, shown by major category type, is included as Exhibit DMD-1. AEP Ohio witness Whitney supports adjustments to that amount that resulted from an internal audit by AEP Ohio and a review conducted by the Commission's Staff in 2012 that, when combined, reduced the AEP Ohio-specific costs attributable to the Phase I work to $20.57 million.

Q. PLEASE GENERALLY DESCRIBE EACH OF THE CATEGORIES INCLUDED IN Exhibit DMD-1.

A. The categories shown in Exhibit DMD-1 are as follows:

- **Internal Costs:** This refers to internal labor expense and other associated costs (such as required travel expenses) for services provided by AEPSC for the Great Bend IGCC project.
- **Process Engineering:** This refers to the main body of work to engineer and design the Great Bend IGCC facility, including site specific scope. This process engineering was performed by GE/Bechtel.
- **AEP Overheads:** These are costs that are associated with benefits, fringes, and loading that result from services provided by AEPSC. These overhead rates are applied to all work that is performed on projects performed by AEPSC.
- **Site Preparation:** These costs include the necessary geotechnical and archeological studies and site activities that were required for eventual use of the Great Bend site for

the IGCC facility.

- **Outside Professional Services:** These costs consist of professional services such as legal services, engineering services, and technology support services that were provided by vendors other than GE/Bechtel.
- **Permits and Fees:** These costs represent the necessary permits for the Company to be able to construct the facility at the Great Bend site, as well as interconnection studies performed by the Regional Transmission Organization

Other Costs and Purchases: These costs reflect other contracted work that supported the Great Bend IGCC Project, including other engineering contracts for project support.

Q. WERE THE COSTS ASSOCIATED WITH THE GREAT BEND IGCC PHASE I ACTIVITIES ESTIMATED WHEN THIS PROCEEDING WAS INITIATED?

A. Yes. In its initial filing in this proceeding, the Company estimated the cost of these Phase I activities to be approximately $18 million, as detailed in the Direct Testimony of Company witness Jasper. This estimate was then updated in the Supplemental Testimony of Company witness Jasper on August 3, 2005, to approximately $23.7 million.

Q. IN YOUR PROFESSIONAL OPINION, WERE THE COSTS INCURRED FOR THE GREAT BEND IGCC PHASE I ACTIVITIES PRUDENT AND REASONABLE?

A. Yes, they were. AEP Ohio diligently and professionally conducted the feasibility study and the FEED study for the Great Bend IGCC project, and the costs incurred during Phase I enabled AEP Ohio to complete those analyses, as it was encouraged to do by the Commission's April 10, 2006 Opinion and Order.

As AEP Ohio witness Jasper explained (and the Commission apparently understood), $20.57 million is a reasonable amount to spend for such Phase I preconstruction feasibility and FEED analyses, particularly when considered in the context of a total anticipated project cost at completion in excess of one billion dollars. These facilities are extremely complex, and it literally takes the work of hundreds of employees

both inside and outside the company to perform the work necessary to establish a good understanding of the costs to construct such a facility, resulting in a more accurate estimate at completion. In fact, if these preconstruction activities are not performed, and the costs not incurred, the risk is higher that the Company will make an uninformed choice when considering the construction of such a generation facility.

Furthermore, the Company leveraged the fact that it was performing other IGCC FEED studies in parallel for all three projects then under consideration, as it realized savings from the efficiency of coordinating those activities. It most certainly would have been more expensive to undertake only one single project than to consider multiple projects with some similar design characteristics. The exact amount of savings that were achieved cannot be quantified, but it is my opinion that these synergies saved a considerable amount of time, effort, and cost that would have been needed had the Phase I pre-construction activities been performed for the Great Bend IGCC Project been performed alone.

Q. DO YOU HAVE ANY INFORMATION THAT THE TOTAL PHASE I COSTS THAT THE COMPANY INCURRED WERE CONSISTENT WITH WHAT OTHER COMPANIES SPEND ON SIMILAR PROJECTS?

A. Yes, at least indicatively. While detailed information regarding the activities undertaken by other companies is difficult to obtain, research uncovered the FEED study costs that were incurred for two other IGCC generating facilities, with those being Duke's Edwardsport IGCC facility in Indiana and also the Genessee IGCC facility in Canada. Based on public documents, it appears that Duke requested approximately $17 million for an IGCC FEED study in 2009, which was approved by the Indiana Utility Regulatory Commission. And, information found that covers the Genessee IGCC project in Canada showed that the FEED

Study for that facility was funded with $33 million. The two documents from which I obtained this information are included in Exhibit DMD-2.

I cannot say with certainty that the activities performed for the aforementioned IGCC FEED studies are exactly comparable to the Phase I activities that AEP Ohio performed when considering the Great Bend IGCC facility, but certainly these publicly available costs are in the same ballpark as the costs AEP Ohio incurred, which indicates that AEP Ohio's costs were in line with typical industry costs.

Q. WHY DID AEP OHIO ENLIST THE HELP OF OUTSIDE FIRMS TO ENGINEER THE GREAT BEND IGCC?

A. AEP has an exemplary history as an engineering company and has been at the forefront of electric generation for over a century. However, IGCC is a very new and different technology for power generation, and GE and Bechtel have significant engineering knowledge of many of the processes used in IGCC plant design. For this reason, it was appropriate to hire those firms to use their knowledge of the IGCC process and help to merge that knowledge with the electric generation knowledge that is housed within AEPSC. For the purposes of completing the Great Bend IGCC FEED Study, there is no doubt that this arrangement was the most efficient way to establish the design and project cost estimate for the eventual construction of the Great Bend IGCC facility.

COST ASSIGNMENT AND ALLOCATION FOR THE GREAT BEND IGCC PROJECT

Q. PLEASE DESCRIBE THE OTHER IGCC-RELATED ACTIVITIES THAT AEPSC WAS UNDERTAKING IN THE SAME GENERAL TIME FRAME AS THE GREAT BEND IGCC FEED STUDY.

A. At different points in the same time frame as AEPSC was performing the Great Bend IGCC feasibility and FEED studies, AEPSC was also considering up to two other potential sites for IGCC facilities. These were the Carrs site in Kentucky (a project undertaken on behalf of AEP Ohio affiliate Kentucky Power Company), and the Mountaineer site in West Virginia (a project undertaken on behalf of AEP Ohio affiliate Appalachian Power Company). AEP was considering these sites and the Great Bend site for the eventual construction of one or more IGCC facilities.

Q. PLEASE EXPLAIN HOW THE COMPANY ALLOCATED AND ASSIGNED COSTS AMONG THE MULTIPLE PROJECTS TO ENSURE THAT THE COMMON COSTS WERE ATTRIBUTED TO THE EACH PROJECT IN THE APPROPRIATE AMOUNTS.

A. The Company identified two types of costs across the three projects. There were common costs that would benefit all projects, which could be allocated proportionally to the work performed for each project, and there were site-specific costs, which would only benefit work at a single site. An example of a common cost would be the design work for the gasifier, gas cleaning process, and the power block that would be common across all installations. A portion of the cost of this type of work was allocated to each project, rather than assigned to one project or another in its entirety. However, costs for work like site preparation, which includes geotechnical studies, archeological studies, and transmission

studies that only benefit the site for which they are performed were not allocated among various sites because they are useful only to the site for which the related work is performed. Accordingly, such costs were directly assigned to the project for which they were incurred.

Also, the timing during which the work occurred had to be considered when looking at the allocation of costs across multiple projects. For instance, Exhibit DMD-3 shows the various states of the different IGCC projects, based on AEP press releases from August 2004 through April 2008. This timeline shows the status of the three potential IGCC projects and the dates for which key decisions were communicated. As detailed in Exhibit DMD-3, the Great Bend site was the first site considered and was the site of primary interest for the Company for construction of an IGCC facility from March of 2005 until June 2007, when work on the Great Bend IGCC project was slowing because of delays in the regulatory process in Ohio, at a time when AEP affiliate Appalachian Power Company was moving forward with filings and receiving conditional approvals for construction. By March 2008, the Great Bend IGCC project was officially on hold due to a lack of clarity regarding the Company's potential to recover the costs of construction and operation of the facility.

Q. WERE YOU INVOLVED WITH THE REVIEW OF THE METHODOLOGIES USED TO ASSIGN AND ALLOCATE THE COSTS?

A. Yes. Because I was involved with each of the projects in question, I was involved in the decision making process that helped develop the methodology for cost allocation among the different IGCC projects.

Q. WHAT ACTIONS DID AEPSC TAKE TO ENSURE THE COSTS FOR THE GREAT BEND IGCC PROJECT WERE PROPERLY ASSIGNED OR ALLOCATED TO THAT PROJECT?

A. AEPSC performed an internal audit of the costs that were incurred for the Great Bend IGCC Project. It confirmed that, in general, costs were properly assigned or allocated to the Great Bend IGCC Project and accurately reflected the work performed on the project. The internal audit that was performed did result in relatively minor changes to the booked costs for the project. The results of the internal audit are discussed by Company witness Whitney.

Q. HAS ANY OTHER REVIEW OF THE GREAT BEND IGCC PHASE I COSTS BEEN PERFORMED?

A. Yes. Subsequent to the Company's internal audit, Commission Staff spent significant time in our offices reviewing the Phase I costs. During the Commission Staff's review of the costs related to the Great Bend IGCC project, both I and other members of my team were involved in providing information to members of the Staff to allow their review to occur. Company witness Whitney discusses the review that Commission Staff conducted as well as the adjustments to the costs incurred during Phase I that the Staff's review produced.

Q. DO YOU BELIEVE THAT THE PHASE I COSTS OF THE GREAT BEND IGCC PROJECT WERE PRUDENTLY INCURRED?

A. Yes. As I have described in this testimony, there was a significant amount of work performed during Phase I to better define the scope and the cost to construct the Great Bend IGCC facility. The work that was performed both internally and externally regarding the Phase I activities associated with the Great Bend IGCC were reasonable, and resulted in a cost estimate for the Great Bend IGCC project. This product comprises a significant body

of knowledge that is only possible because of these activities undertaken by AEP Ohio.

The magnitude of the costs incurred was in line with the experience of others in the industry. I provided two examples of IGCC FEED Study costs incurred by other companies that were both in the same ballpark as the costs incurred by AEP Ohio.

Also, AEP has gone to great lengths to review the costs that were assigned and allocated to each project. As described in the testimony of Company witness Whitney, only relatively small adjustments were made to the costs that were incurred for the Great Bend IGCC Phase I activities. This further supports the conclusion that the costs incurred to perform the Phase I activities were reasonable and prudent.

Q. NOW THAT AEP OHIO HAS NOT PROCEEDED WITH CONSTRUCTION OF THE PROPOSED GREAT BEND IGCC FACILITY, ARE THERE ANY EXPENDITURES ASSOCIATED WITH ITEMS THAT MAY BE UTILIZED IN PROJECTS AT OTHER SITES BEYOND THOSE THAT HAVE ALREADY BEEN PROPERLY ALLOCATED?

A. No. As I explained previously, portions of the common costs associated with Phase I activities for AEP Ohio's Great Bend IGCC facility have already been allocated to the Mountaineer and Carrs projects. Other than expenditures for those common costs, there are no Phase I expenditures by AEP Ohio on the Great Bend IGCC project that are associated with items that may be utilized at other sites. First, there are no elements of the Great Bend IGCC project that would be re-usable in projects at other sites. Second, in any event, there are no other active IGCC projects at other sites that are currently being considered for construction. Consequently, even if other elements were re-usable in theory (and there are none), there are no other projects to which such elements, and their costs, could be

transferred.

Q. DOES THIS CONCLUDE YOUR DIRECT TESTIMONY?

A. Yes.

AEP Ohio Great Bend IGCC

Phase I Costs by Category

Category	Total
Internal Costs	$8,014,929.99
Process Engineering	$4,832,800.00
AEP Overheads	$3,512,987.52
Site Preparation	$2,757,780.86
Outside Professional Services	$1,353,105.55
Permits and Fees	$425,410.21
Other Costs and Purchases	$177,360.98
Grand Total	**$21,074,375.11**

DMD Exhibit 2

Pages 2-11: Duke Energy Project Overview of Edwardsport IGCC Plant and Proposed CCS Project

Page 12: Genessee Plant IGCC Front End Engineering Design Study information

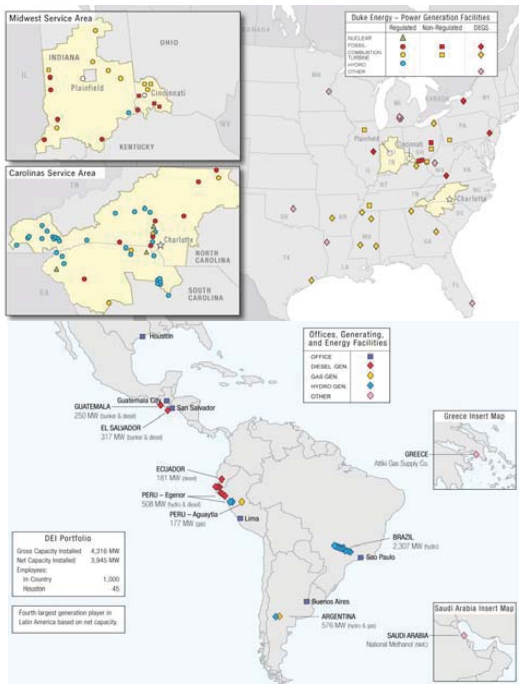
Project Overview of Edwardsport IGCC Plant and Proposed CCS Project

CSLF Financing Roundtable

Darlene Radcliffe

Director, Environmental Technology & Fuel Policy

About Duke Energy



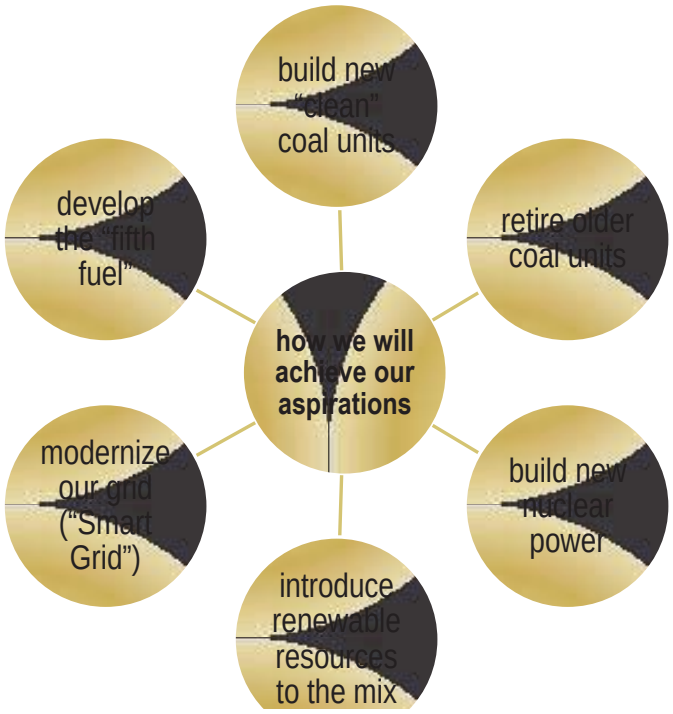
- Operating revenues: $15.2 billion (U.S.)
- Total Assets: $49 billion
- Employees: 18,109
- Total U.S. Generating Capacity: 36,000 MW
- Franchised electric operations in 5 states serve 4 million electric customers
- Total Duke Energy International Generating Capacity: 4,000 MW, primarily in Latin America

Duke Energy's Aspirations

1. **De-carbonize our power generation**
2. **Help make our communities the most energy efficient in the world**

"These aspirations are grounded in our commitments to provide our customers with clean, affordable and reliable electric and gas services."

Jim Rogers
Chairman, President and CEO



Edwardsport IGCC Plant Overview

- Project Owner – Duke Energy Indiana
- Location – Edwardsport, Indiana
- IGCC Technology – GE Energy
- 630 MW base load generation
- Existing circa 1940's units (160 MW) to be retired prior to start-up
- Online 2012
- Approved Budget = $2.35 B

Project Milestones

- Received $133.5 million Federal Investment Tax Credit Award – November 2006
- Received CPCN from Indiana Utility Regulatory Commission (IURC) – November 2007
- Air Permit issued – February 2008
- Awarded ~ $1 million by DOE (Midwest Regional Carbon Sequestration Partnership) for carbon sequestration assessment activities – May 2008

Environmental Benefits

- 80% reduction in criteria pollutants compared to current plant
  - Current plant emits 13,000 tons of SO_2, NOx and particulate emissions annually and operates 30% of the time
  - New IGCC plant will emit 2,900 tons of SO_2, NOx and particulate emissions annually while operating 100% of the time
- Less water usage (approximately 30%) compared to a conventional pulverized coal plant
- Generate less solid waste than a conventional pulverized coal plant
- Byproducts: sulphur and vitrified, non-leachable slag will be beneficially reused
- More economic to retrofit with CCS
  - Removing carbon dioxide from fuel rather than flue gas
  - Less auxiliary power needed than conventional pulverized coal plant

Key Economic Benefits

- Plant will employ an estimated 120 people
  - Majority of jobs will be high-skill/high-paying
  - Estimated annual payroll of $7 to $9 million
- Construction jobs will average an estimated 800 – 900 during the three year construction period
- 2,000 jobs during peak construction
- Increased tax base for local and state economies
  - Property taxes to be paid in years 1-10 are approximately $33.3 million
  - Property taxes to be paid beginning year 11 are approximately $5.2 million
- Ability to use local Indiana and Midwestern coal. Plant will use 1.7 to 2 million tons of coal annually

Proposed CCS Project

- The general arrangement design of the Edwardsport IGCC plant was created in anticipation of adding carbon capture equipment at a future date.
- In January 2009, the Indiana Utility Regulatory Commission approved a $17 million FEED study for CO_2 capture at the Edwardsport IGCC plant.
- GE completed the process design phase of the study in December 2009. GE and Burns & McDonnell are currently preparing a preliminary design and cost estimate. The study will be complete in March 2011.
- Duke Energy has an application pending before the Indiana Utility Regulatory Commission to proceed with further saline storage site characterization. If approved, the $42 million phase I study would proceed immediately.
- Duke Energy is also investigating other sequestration options in depleted oil and gas fields, as well as possible commercial opportunities for enhanced oil recovery in the Illinois Basin

CCS Issues

LEGAL

Liability

- Identify and assess potential risks associated with long term storage of CO2
- Define operations, pre-closure verification period, and post closure risk obligations and structure
- Determine who has long term environmental stewardship responsibilities

Property Rights

- Identify how pore space will be addressed

PERMITTING

Identify regulating entity

- A new Class V permit was created by USEPA for research projects under the Underground Injection Well program (Safe Water Drinking Act). A new Class VI has been proposed for CO2 injection wells.

Identify requirements

- Site selection and characterization
- Monitoring, measurement and verification
- Financial assurances

EDUCATION

Stakeholder education

- Customers
- Employees
- Media
- Public
- Regulators and other federal, state and local government officials
- Shareholders

"Public acceptance and understanding of carbon storage is a critical step in establishing it as a viable greenhouse gas mitigation option." NETL


Edwardsport IGCC Plant
www.duke-energy.com

Natural Resources Canada | Ressources naturelles Canada

IGCC Front End Engineering Design Study

Project type	Preliminary engineering/FEED
Project proponent	Capital Power Corporation
CO_2 source	Genesee coal-fired electricity power plant
Capture application	Coal-fired electricity generation
Project timeframe	2006 to 2010
Project location	CPC's Genesee power plant, located west of Edmonton, Alberta, Canada
Funding	
Government of Canada	$11 million
Provincial government	$11 million
Private sector	$11 million
Total project cost	$33 million

Project description

Between 2006 and 2010, Capital Power Corporation (CPC), on behalf of the Canadian Clean Power Coalition, performed a Front End Engineering Design (FEED) study for an approximately 240-megawatt (MW) (net) integrated gasification combined cycle (IGCC) facility with carbon dioxide capture. This study was aimed at discovering the true cost and viability of such a facility, which would be built at the existing Genesee Generating Station in Alberta, Canada, approximately 50 kilometres west of Edmonton.

The facility was designed to provide baseload electric power to the Alberta electricity grid, with carbon capture of more than 85 percent and a significant reduction in all other criteria air emissions. The project's final report discusses the process, methodology, engineering and cost estimates completed in the course of producing the FEED work. It also outlines the costs and benefits associated with the facility and possible areas of investigation for future study. The study found that there are no major technical issues with using western Canadian subbituminous coals in a carbon capture IGCC facility and was able to develop detailed cost estimates for the construction and operation of such a facility.

Outcomes

The Genesee IGCC FEED study was a significant undertaking, and a substantial amount of knowledge was gained regarding the development of gasification for power generation in Alberta. The final report highlights the challenges associated with high capital and operating costs for advancing IGCC with carbon capture and storage technologies.

Proponent profile

Capital Power is a North American, independent power producer. The company is recognized as one of North America's most respected, reliable and competitive power generators. CPC has interests in 32 facilities across North America, with nearly 3800 MW of owned or operated power generation capacity, as well as 371 MW of capacity owned through power purchase agreements. Headquartered in Edmonton, Alberta, Capital Power draws on a 118-year heritage of innovation and reliability and a history of developing, acquiring, operating and optimizing power generation from a diverse range of energy sources. Capital Power employs approximately 1100 people.

Proponent Web sites

www.capitalpower.com
www.capitalpower.com/MediaRoom/news/Pages/igccreport.aspx

Aussi disponible en français sous le titre :
Étude de l'ingénierie de base pour le cycle combiné à gazéification intégrée

Canada

AEP News Release Summary
IGCC FEED Study Activity

Date	Announcement	Primary Site	Other Sites
8/31/2004	Announced to build at least one IGCC plant	N/A	N/A
2/10/2005	3 Potential Sites (PJM Interconnection Applications), certainty of regulatory recovery necessary	N/A	Mountaineer (APCO) Great Bend (OPCo) Carrs (KPCO)
3/18/2005	PUCO Application for Cost Recovery Filed in response to PUCO suggestion that AEP Pursue IGCC in Ohio	Great Bend	Mountaineer Carrs
6/17/2005	Great Bend is Primary Focus, not regulatory action yet taken in WV or KY	Great Bend	Moutaineer Carrs
8/10/2005	Ohio Remains primary site, same as 6/17/2005 and 3/18/2005	Great Bend	Moutaineer Carrs
9/29/2005	GE/Bechtel Alliance Engaged for Great Bend FEED Study.	Great Bend	Moutaineer Carrs
3/21/2006	AEP initiated process for regulatory approval in WV. Great Bend remains primary site	Great Bend	Moutaineer
4/10/2006	PUCO approved recovery of preconstruction costs. Cost recovery request from WV pending. Great Bend remains primary site	Great Bend	Moutaineer
4/25/2006	Great Bend remains primary site. WV request for approval pending	Great Bend	Moutaineer
8/10/2006	AEP Executes agreement with GE/Bechtel Alliacnce for FEED study at Mountaineer site. Ohio and WV both active sites (no related news release. See agreement at C.2.32)	Great Bend Mountaineer	
6/18/2007	WV request for IGCC plant cost recovery pending, additional testimony filed. Ohio project slowing due to regulatory challenges	Great Bend Mountaineer	
3/7/2008	WV granted CPCN, cost recovery mechanism. APCo filed recovery request with VA.	Great Bend Mountaineer	
3/14/2008	Ohio project on hold until AEP has clarity regarding the future of electricity generation in Ohio	Mountaineer	Great Bend
4/22/2008	VA Requested APCo's request for cost recovery. All projects on hold until there is regulatory certainty. However, AEP remains committed to the technology.	N/A	N/A

Summary: Testimony Direct Testimony of Daniel M. Duellman on behalf of Ohio Power Company electronically filed by Ms. Christen M. Blend on behalf of Ohio Power Company