



ANNUAL PROJECT REPORT
AS OF DECEMBER 2000

1. Project Sponsor

Ohio Department of Development

Ohio Coal Development Office

77 South High Street, 25th Floor

P.O. Box 1001

Columbus, Ohio 43216

2. Project Manager

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3. OCDO Grant No. CDO/D-98-8

4. Project Update OR

Final Report

5. Project Title: Engineering and Economics of CO2 Sequestration/Use on

an Existing Coal-Fired Power Plant

6. Project Term :

From: November 1, 1999

To: June 30, 2001

7. Budget:

Name

Cost Share

OCDO

\$250,000

DOE-NETL *

250,000

ALSTOM Power Inc.

\$149,200

\$

PROJECT TOTAL

\$649,200

* DOE-NETL Contract N^o: DE-FC26-99FT40576

8. OVERVIEW OF PROJECT & OBJECTIVES

The overall objective of this study is to evaluate the technical feasibility and the economics of alternate CO₂ capture and sequestration/use technologies for retrofitting an existing coal fired power plant. ALSTOM POWER Inc. and AEP share OCDO's concerns and interest in maintaining and increasing the use of Ohio mined coals for power generation in an environmentally acceptable manner. On-going technical discussions concerning greenhouse gases and proposed international agreements leading to future mandates for greenhouse gas mitigating increase the need for thorough technical and economic understanding of solutions. To address these needs, ALSTOM POWER Inc. offered a comprehensive study to assess both the technical feasibility and economics of retrofitting an existing coal-fired plant with systems capable of: (1) potential zero emission level of CO₂ by means of CO₂ separation and/or sequestration technologies; and (2) significant reduction of NO_x (more than 30% of uncontrolled NO_x) through modified combustion environment. This study was in response to category 5 of OCDO's Solicitation '98 – Clean Coal Technology. Category 5 is "development and demonstration of technologies and techniques for reducing or mitigating emissions of greenhouse gases in ways which benefit the use of Ohio coal."

The study is designed to evaluate three alternate CO₂ capture and sequestration/use systems and their impact on an existing boiler, associated auxiliary components, overall plant performance, and overall power plant costs, including the cost of electricity (COE). In addition, NO_x emission reduction is achieved by replacing conventional combustion air system with combustion technology based on O₂/ flue gas recirculation mixture. Bench scale combustion testing is being conducted to evaluate potential reduction in NO_x emission. Bench-scale testing was also proposed to evaluate overall combustion kinetics and fuel burnout.

The deliverable of this project will be a comprehensive report documenting the design, cost and economics of three alternate CO₂ sequestration technologies applied to an existing Ohio coal-fired power plant (AEP's Conesville Station Unit #5). The output of this study will:

- Enhance the public's understanding of control options for existing coal-fired power plants; and
- Influence decisions and actions by government, regulators, and coal-fired power plant owners to reduce the emission of CO₂, which is an important greenhouse gas.

9. WORK DONE

The project Work Breakdown Structure is shown in Figure 1. Tasks 1 and 2 (Literature Survey and Site Selection/Plant Evaluation) are complete. Progress reports were issued on these work facets. Task 3 (Boiler Island Assessment) is about 95% complete. Task 4 (Bench-Scale Testing and CFD Evaluation) is about 90% complete. Work on Task 5 (Economic Assessment) is underway.

WBS	Task Name	Y1999		Y2000												Y2001						Status as of December 31, 2000
		Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	
1	Literature Survey	■	■	▲																		Completed
2	Site Selection/Plant Evaluation			■	■	■	▲															Completed
3	Boiler Island Assessment							■	■	■	■	■	■	■								-One month delay
3a	Coal Comb. in Air with Available CO ₂ Separation							■	■	■	■	■	■									
3b	Coal Comb. in CO ₂ O ₂ without CO ₂ Separation							■	■	■	■	■	■									
3c	Novel Concepts Evaluation							■	■	■	■	■	■									
4	Bench-Scale Testing and CFD Evaluation						▲	■	■	■	■	■	■	■								-four month delay
4a	Bench-Scale Testing							■	■	■	■	■	■									
4b	CFD Evaluation							■	■	■	■	■	■									-four month delay
5	Economic Assessment													■	■	■	■	■	■			-two month delay
6	Project Management	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	New target: 30 June 00

▲ Decision Points (Successfully Completed) ■ Estimated New Delivery Date
 NOTE: A request was made on December 6, 2000 to extend -- at no additional cost -- the project end date from March 31, 2000 to June 30, 2000

Figure 1 Project Work Breakdown Structure (WBS)

10. PLANS FOR COMING YEAR

Complete work on the following items:

1. Finalize technical analysis of the three concepts, bench-scale testing and CFD analysis
2. Costing
3. Economics
4. Final Report:
 - Preparation of Draft Report
 - Review of the Draft Report by OCDO and DOE NETL
 - Issue Final Report

I. HIGHLIGHTS/ACCOMPLISHMENTS

11 Results from the technical analysis of the three Concepts being evaluated preliminarily indicates the following:

- No major technical barriers exist for retrofitting AEP's Conesville Unit #5 to capture CO₂ for the three concepts under study (Task 3)
- Energy requirements and power consumption are high, resulting in significant decrease in overall power plant efficiencies, as shown in Table 1
- Budgetary costs, which are in the process of being estimated, indicate high investment costs for any of the concepts under consideration.

Table 1

Preliminary Results from AEP's Conesville Unit #5 Power Plant

Parameter	Concept			
	Base	Concept 3A CO2 Capture with MEA	Concept 3B Oxy-fired Boiler	Concept 3A CO2 Capture with MEA/MDEA
Plant Efficiency (HHV), %	35	20	24	21
Net Power Output, MWe	434	250	291	313
CO2 Emissions, lbm/kWh	1.997	0.202	0.175	0.185
CO2 Liquid Product Purity, %	N/A	99.95	97.8	99.97

II. ARTICLES/PRESENTATIONS

12. Technical Papers:
-- Coal Tech Conference
-- First National Sequestration Conference
-- ASME IJPG Conference