DOE/PC/94114--T11

INSTALLATION OF A STOKER-COAL PREPARATION PLANT

IN

KRAKOW, POLAND

Technical Progress Report 11

October - December 1996

Cooperative Agreement DE-FC22-94PC94114

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DISCLAIMER

ABSTRACT

This project is one of eight projects selected under the assessment program in the Support of Eastern Democracy (SEED) Act of 1989 by the federal government to reduce low-level emission sources in the Krakow area of Poland.

The objective of this Cooperative Agreement is to demonstrate that the quality of stack gas emissions can be improved through the substitution of run-of-mine coal by washed coal. To this end, EFH Coal Company will design, build, and operate a 300-mtph (330 stph) preparation plant and produce a low ash, double-screened washed coal for burning in a traveling-grate stoker in one of the many water heating plants in the city of Krakow. By burning this prepared coal under proper combustion conditions, combustion efficiency will be increased, stoker maintenance will be lowered and the amount of carbon monoxide, sulfur dioxide and particulates in the stack gases will be reduced significantly.

Contracts to: provide the raw-coal feed to the plant; dispose of plant wastes; burn the clean coal in a demonstration water heating plant in Krakow; and to market any surplus production are in place.
An international irrevocable purchase order has been let for the procurement of a customized modular 300 mtph (330 stph) dense medium cyclone preparation plant to wash the 20 mm. (≈ ¾ in.) by 5 mm. (≈ ¼ in.) size fraction of raw coal produced by the Katowice Coal Holding Company. This plant will be fabricated and shipped from the United States to Poland as soon as the final land-use and construction permits are granted.

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EXECUTIVE SUMMARY

With the exception of *Task 1.0 - Coal Characterization and Combustion Performance*, all activities under Budget Period I have been accomplished. A Continuing Application requesting additional funds to perform the work described under Budget Period II was requested and was granted.

An international irrevocable purchase order for a 300 mtph (330 stph) capacity dense medium cyclone to wash the 20 mm. (≈ ¾ in.) by 5 mm. (≈ ¼ in.) size fraction of run-of-mine raw Polish coals was negotiated. This plant is a custom modular plant that will be fabricated in the United States shipped to Poland for assembly at a site near the Kazimierz mine; assembly will begin as soon as the final land-use and construction permits are received.

INTRODUCTION

The work being performed under this Cooperative Agreement between the United States Department of Energy (DOE) and EFH Coal Company (Participant) is one part of the assessment program in the Support for Eastern European Democracy (SEED) Act of 1989 (P.L. 101-179).

In October 1991, a Memorandum of Understanding (MOU) titled "Collaboration on the Krakow Clean Fossil Fuels and Energy Efficiency Program, A Project for Elimination of Low Emission Sources in Krakow" was signed by the DOE and the Ministry of Environmental Protection, Natural Resources and Forestry of the Republic of Poland, that describes the cooperation that is being undertaken by the respective governments to accomplish the goals of this program.

The DOE has selected eight U.S. companies to work with the government of Poland to improve the country's air quality, particularly around the historic city of Krakow. Although the program is focused on Krakow, it is intended to serve as a model for similar pollution control programs throughout Poland and, hopefully, much of Eastern Europe. The total cost of the SEED program is $31 million with the DOE funding about half that amount.

Low emission sources in the Krakow area include 100,000 home stoves, 227 traveling-grate (stoker-fired) boilers and more than 2,000 hand-fired boilers -- all coal fired.

PURPOSE

The purpose of the U.S./Polish Memorandum of Understanding is to encourage the formation of commercial ventures by providing project development support, resources, and services to reduce low-emission sources in Krakow, Poland.

These commercial ventures can take the form of contracts, joint ventures, partnerships, and other commercially-feasible arrangements to achieve the purposes of this statute.

OBJECTIVE

The specific objective of the work being performed by EFH Coal under the terms of this Cooperative Agreement is to improve the quality of stack gas emissions from low-stack boilers in the Krakow area of Poland.

This objective will be accomplished by designing, constructing, and operating a beneficiation facility that will produce a low-ash, double-sized stoker coal for burning in a typical traveling-grate stoker commonly in use for heating water throughout this area. The low-ash, uniformly sized, quality stoker coal when burned properly in existing boilers will increase combustion efficiency, reduce stoker maintenance, and reduce significantly carbon monoxide, sulfur dioxide, and particulate levels in stack gas emissions.

To facilitate the achievement of the stated objective, EFH Coal has executed an agreement with MPEC (a district heating company in Krakow) and Naftokrak/Naftobudowa (a construction and maintenance enterprise) to design, construct and operate a 300 mtph (330 stph) coal cleaning facility. EFH Coal has also subcontracted with the Pennsylvania State University to characterize two candidate Polish coals and to perform combustion tests on washed sublots of these Polish coals in their combustion simulator facility.

WORK STATEMENT

It was projected that a two-year effort would be needed to accomplish the objectives of this Cooperative Agreement, consisting of two budget periods and including the following ten tasks:

Budget Period I

Task 1 - Polish Coal Washability and Combustion Performance Evaluation
Task 2 - Raw Coal Supply Contracts
Task 3 - Specification of Major Preparation Plant Components
Task 4 - Preparation Plant Flowsheet Design
Task 5 - Cost Evaluations
Task 6 - Securing Stoker Coal Supply Contracts
Task 7- Final Economic Evaluation and Risk Assessment

Budget Period II

Task 8 - Preparation Plant Component Procurement
Task 9 - Plant Construction
Task 10 - Plant Startup and Demonstration

RESULTS AND DISCUSSION

To date *Tasks 2 through 7* of the seven tasks proposed for Budget Period I are essentially completed; work on *Task 1 - Polish Coal Washability and Combustion Performance* has not been initiated.

Subtask 1.1 - Washability Characterization consists of obtaining a sample of the raw coal (or blend of raw coals) that will be fed to the proposed coal preparation plant and ship this sample to The Pennsylvania State University (PSU) for washability studies. These tests include screening the sample into a number of size fractions and then separating each of these size fractions into a number of specific-gravity fractions. Each of these resulting screen/specific-gravity components will then be analyzed for such quality parameters as ash, sulfur, volatile matter and calorific content. With these data it is possible to predict the range of clean coal products that might be produced theoretically in terms of both quantity and quality; and it also is possible, given the types of washing equipments utilized, to simulate the range of product recoveries and qualities that can be produced actually from various plant feeds.

Although long-term contracts are in place with the Katowice Coal Holding Company for the supply of raw coal to the proposed plant, the exact source of this supply is yet to be established -- thus it has not been possible to obtain a representative sample of the proposed raw-coal feed to the plant. Fortunately this lack of data has not deterred progress significantly as the Poles have historic washability data on their raw coals that are adequate for the selection of a generic plant design and for the prediction of the expected plant performance in terms of product qualities and yields. The washability data for one of the candidate coals (20 mm. (≈ ¾ in.) by 5 mm. (≈ ¼ in.) size fraction from the Staszic Mine) was cited in Table 1 in Quarterly Technical Progress Report 2; the predicted results (over a range of specific gravities of separation) expected when this coal was washed in either a heavy medium cyclone or Baum jig were shown in Table 2 in the above report.

The purpose of *Subtask 1.2 - Stoker Performance Evaluation* is to utilize the combustion simulator facilities available at PSU to study the combustion characteristics of a range of washed coals produced under *Subtask 1.1* in an effort to fix such operating parameters as coalbed thickness, grate travel rate, air requirements, and clinker formation in an effort to optimize the performance of the MPEC demonstration stoker-fired water heating plant in Krakow, Poland. Activation of this subtask awaits the availability of samples of washed coal.

Effort on *Subtask 1.3 - Training Program* has not been initiated pending the selection of a scientist and a plant operator by the Poles.

Technical assistance by PSU faculty combustion experts under *Subtask 1.4 - Technical Assistance During the Boiler Demonstration* is not scheduled to begin until the MPEC demonstration water heating plant is in good operating condition.

Budget Period 2 tasks include all of the activities that are required in procuring, transporting plant components to the site, site preparation, erecting the plant, installing materials handling facilities and providing for environmentally-acceptable liquid and solid waste disposal systems.

Task 8.0 - Preparation Plant Component Procurement. It was determined that it would be less complicated, timelier, and less expensive to purchase a prefabricated modular plant built in the United States than to purchase a mix of Polish and American equipment and fabricate and erect the plant on site. To wit, a generic plant customized to meet the specific requirements of this project has been selected from Taywood Mining Inc. This plant is capable of washing 300 mtph of plus 5 mm. (≈ ¼ in.). Polish raw coal (or blend of raw coals) in a heavy-medium cyclone with great efficacy. An international irrevocable purchase order for this plant to be delivered at some unspecified future date has been placed. This plant is completely modular and will be transported from the United States via container ship.

Activities relevant to *Task 9.0 - Plant Construction* and *Task 10 - Plant Startup and Demonstration* are on hold currently due to the lack of a land use permit and a construction permit; applications for these essential permits have been made, but approval has yet to be granted.

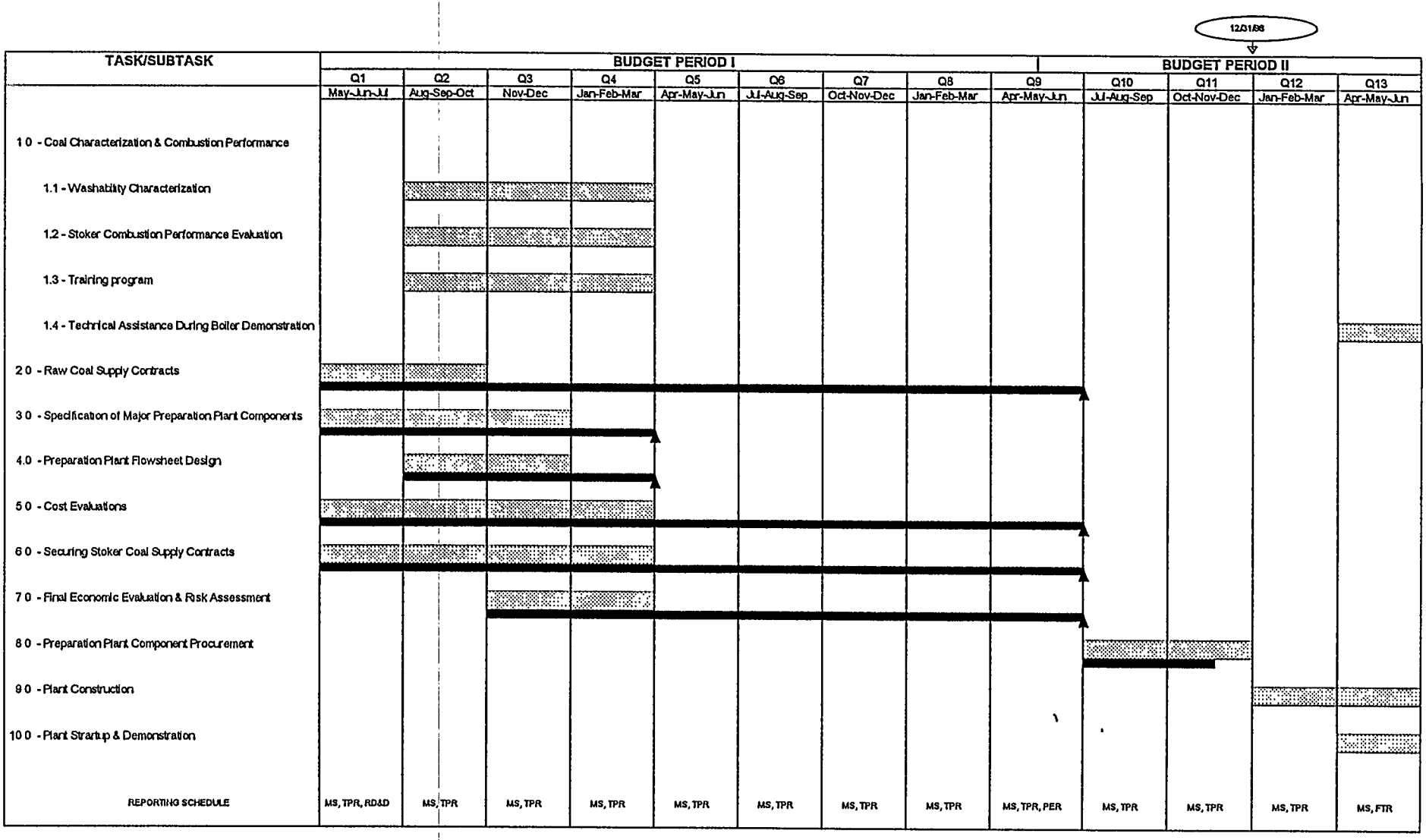
CONCLUSION

From the achievements to date it may be concluded that all of the programmed tasks under Budget Period I essential to the success of this Cooperative Agreement (save *Task 1.0*) have been completed. Under Budget Period II, once the remaining permits are granted the modular preparation plant will be shipped from the United States to the site, assembled and the production of a high-quality stoker coal initiated. This stoker coal, when burned under proper combustion conditions in a typical water-heating plant will, prove to perform with higher thermal and mechanical efficiency and produce significantly less air pollution than when the plant was operated on run-of-mine coals.

Figure 1 - GANTT CHART

KRAKOW CLEAN FOSSIL FUELS AND ENERGY EFFICIENCY PROGRAM

INSTALLATION OF A STOKER COAL PREPARATION PLANT IN KRAKOW, POLAND



Report Legend

MS - Federal Assistance Management Summary
TPR - Technical Progress Report
RD&D - Notice of Energy RD&D Project
FTR - Final Technical Report
PER - Project Evaluation Report

Performance Legend

PLANNED

ACTUAL

TASK COMPLETED