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"MULLED COAL - A BENEFICIATION COAL FORM
FOR USE AS A FUEL OR FUEL INTERMEDIATE"

Contract No. DE-AC22-90PC90167

Technical Progress Report No. 10
For the Period July 1, 1992 through September 30, 1992

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Report No. 90167-010

Submitted: January, 1993

FINAL

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I. EXECUTIVE SUMMARY

Energy International Corporation was awarded a contract by DOE-PETC (DE-AC22-90PC90167) to evaluate a new concept for utilization of the fine coal wet cake produced by many of the physical beneficiation processes now under development. The project started with the selection of coal feedstocks on May 15, 1990. This report covers activities from July 1, 1992 through September 30, 1992.

II. INTRODUCTION

Under the auspices of the Department of Energy and private industry, considerable progress has been made in:

- o preparation of coal-water fuels
- o combustion of low-ash coal-based fuel forms
- o processes to provide deeply-cleaned coal

These technology advances are compatible with the national objective to increase the environmentally responsive use of readily available and abundant coal resources, and to reduce oil and gas fuel consumption.

As these technical developments move toward commercial application, the need for coordinated efforts and integrated requirements has become increasingly apparent. Systems are vitally needed to integrate energy delivery systems from the raw resource through processing to application and end use. Problems have been encountered in the preparation of conventional coal-water fuels that mutually satisfy the requirements for storage stability, handling, preparation, atomization, combustion, and economics. Experience has been slow in evolving generic technologies or products and coal-specific requirements and specifications continue to dominate the development. Thus, prospects for commercialization remain highly specific to the coal, the processor, and the end use.

Developments in advanced beneficiation of coal to meet stringent requirements for low ash and low sulfur can be anticipated to further complicate the problem areas. This is attributable to the beneficiated coal being procured in very fine particles with high surface areas, modified surface characteristics, reduced particle size distribution range, and high inherent moisture. Experience in the storage, handling, and transport of highly beneficiated coal has been limited. This is understandable, as quantities of such product are only now becoming available in meaningful quantities.

Since the inception of the project, we have:

- o Developed formulations to stabilize wet filter cake into a granular free flowing material (Mulled Coal).
- o Applied the formulation to wet cake from a variety of coal sources ranging from anthracite to subbituminous coal.
- o Evaluated effects of moisture loss on mull properties.
- o Developed design concepts for equipment for preparing the Mulled Coal and converting it into Coal Water Fuel.

- o Obtained storage and handling system design data for the granular coal.
- o Completed the 74-day aging study on various mull formulations to determine the effects of time and exposure on mull properties.
- o Demonstrated the continuous production of mulled coal from wet filter cake.
- o Performed atomization studies on Mulled Coal and CWF prepared from Mulled Coal.
- o Developed a standardized set of empirical tests to evaluate handling characteristics of various mull formulations.
- o Completed integrated, continuous mulling process circuit design.

This report covers activities from July 1, 1992 through September 30, 1992. During this period we have:

- o Begun weathering studies on neat mull and source fuel.
- o Completed design of integrated continuous process circuit for mull formulations.
- o Extended aging studies on various mull formulations.
- o Started cost estimates on 100 tph mulling circuit.

III. PROJECT DESCRIPTION

The Mulled Coal project was divided into a series of tasks designed to produce formulations and system designs suitable to convert fine coal "wet cakes" into materials that can be stored, handled, and transported to a site where it can be utilized as a fuel in existing and developing combustion devices.

The work was divided into three phases:

Phase I provided the technology base and established the technical feasibility of the concept of stabilizing the fine coal "wet cake" in a form that can be readily stored and moved to the location where it is either combusted "as is" or converted into a desired fuel form. The information developed during Phase I provides a basis for design and implementation of a demonstration program (Phase II).

Phase II demonstrated the ability to utilize the Mulled Coal to improve the ability to store and move fine coal products as a stable "wet cake". Tasks in this phase tested components of the fine coals and subsequently demonstrated operations of an integrated system for storing, handling, and combustion of the highly beneficiated fine coal products.

Phase III activities will broaden the technology base for Mulled Coal application(s). Energy International will prepare and evaluate mulls and CWF's from a wider range of coals than studies in Phase I/II. Two bituminous coals will be cleaned at utility and finer grind (20 microns) to gain more information on particle size and beneficiation effects. Mulls from other feed coals will also be evaluated with various mulling agents and blends of reagents.

Phase I - Once the feed coals were selected, basic technical information for formulations of Mulled Coal were developed through bench studies. Some base assumptions for the process concept were:

1. Chemical formulations will have to consider end use as well as the chemistry involved with the beneficiated processes.
2. If any changes in particle sizes are required for the combustor, they should be made before formulation of the Mulled Coal.
3. Conversion of Mulled Coal to the final fuel form should require minimal equipment and relatively moderate conditions such as dilution, addition of small quantities of reagents, mild agitation, and little heating. Grinding, high temperatures, corrosive or hazardous materials, etc. should be minimized.

Phase II - Phase II comprised the design, acquisition, and testing of the system components required to simulate the storage, transportation and combustion of the "mulled coal" formulation(s). The "mulled coal" was prepared in sufficient quantities to perform a full system test of the preferred formulations, including atomization evaluation.

Prior to the conclusion of Phase II activities a contract extension was applied for and received. The extension has been referenced as Phase III.

Phase III - This scope of work addresses the expanded studies for storage, transport and handling of beneficiated coal products in the form of granular mulled coal. The mulled coal process will be applied to a wider range of coals involving an additional variety of reagents.

IV. PROJECT STATUS

- 1.0 Phase I - Technology Development (completed).
- 2.0 Phase II - System Demonstration (completed).
- 3.0 Phase III - Extended Studies

3.1 Management and Administration

Project administration activities involved acquisition of mulling reagents and preparation of scheduled reporting requirements.

3.2 Acquisition of Beneficiated Coal Products

Beneficiated coal products have been acquired.

3.3 Formulation Studies

Various mull formulations continue to be evaluated for commercial cost effectiveness.

3.4 Extended Handling Studies

Aging/weathering studies on neat mull and source fuel formulations are underway.

3.5 Plant Design

The integrated continuous process circuit design is complete and prototype testing underway. The cost estimate for a 100 tph mulling circuit is being reviewed.

V. PLANNED ACTIVITIES

Continue aging studies on selected mull formulations. The integrated continuous process circuit will be tested with necessary modifications being made. A final cost estimate for a 100 tph circuit will be completed.

VI. SUMMARY

Progress has been made on the continuous process circuit to convert wet cake to mull formulations. Testing and fine tuning of the circuit will continue. The weathering studies on selected formulations has started with completion estimated in November, 1992. An initial design and associated cost estimate for a 100 tph mulling circuit is being reviewed.

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