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

Contract No. DE-AC22-90PC90167

Technical Progress Report No. 11
For the Period October 1, 1992 through December 31, 1992

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FINAL

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TABLE OF CONTENTS

	<u>Page No.</u>
I. EXECUTIVE SUMMARY.	1
II. INTRODUCTION	1
III. PROJECT DESCRIPTION.	2
IV. PROJECT STATUS	3
1.0 Phase I - Technology Development.	3
2.0 Phase II - System Demonstration	3
3.0 Phase III - Extended Studies.	3
3.1 Management & Administration.	3
3.2 Acquisition of Beneficiated Coal Products.	3
3.3 Formulation Studies.	4
3.4 Extended Handling Studies	4
3.5 Plant Design	4
V. PLANNED ACTIVITIES	4
VI. SUMMARY.	4

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 October 1, 1992 through December 31, 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 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 in 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 October 1, 1992 to December 31, 1992. During this period we have:

- o Completed coal aging studies.
- o Plant design being reviewed.
- o Begin Final Report preparation.

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 two 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 micron) 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 Muddled 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 Muddled Coal.
3. Conversion of Muddled 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 "muddled coal" formulation(s). The "muddled 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 muddled coal. The muddled 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).

All design and application studies are complete. Phase II final report is being prepared.

- 3.0 Phase III - Extended Studies

3.1 Management and Administration

Project management activities include contacting contractors concerning equipment specifications for plant design efforts. Administrative functions continue to provide scheduled reports and accounting.

3.2 Acquisition of Beneficiated Coal Products

Beneficiated coal products have been acquired.

3.3 Formulation Studies

Studies involving various reagents for mull formulations and conversion to coal water fuels have been completed.

3.4 Extended Handling Studies

Coal aging studies have been completed. Analytical test results of the mull properties are being evaluated.

3.5 Plant Design

Plant design activities are near completion. Preparation of a Final Report will be started.

V. PLANNED ACTIVITIES

Plant design and cost estimates will be completed. Analytical test results of the coal aging studies will be available for review.

VI. SUMMARY

Results of the entire test program are being evaluated. Plant design activities are near completion. Preparation of the Final Report has started with a focus on the commercial application of mulled coal products including the appropriate economic considerations.

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