SECTION 1

INTRODUCTION

This report presents the results of a conceptual design and economic evaluation for a commercial complex to mine high-sulfur coal and produce substitute natural gas (SNG), fuel oil, naphtha, and liquefied petroleum gases (LPG) using hydroliquefaction technology for the coal conversion portion of the complex.

This work was performed for the Energy Research and Development Administration (ERDA) - Fossil Energy, Demonstration Plants Division, whose guidance and support in these activities are gratefully acknowledged. The design uses the teachings of the ERDA-sponsored solvent refined coal (SRC) hydroliquefaction and entrained slagging gasification programs, with adaptation to the specific Oil/Gas objectives. Pseudo catalytic SRC II hydroliquefaction techniques are used in which a portion of the hydroliquefier effluent is recycled to the hydroliquefier reactor to provide a higher content of ash constituents, longer reaction time, and greater hydrogen consumption to produce products that are primarily gases and liquids at ambient conditions.

The design basis was developed in cooperation with ERDA.

1.1 OBJECTIVES

The objectives of the work described in this report are to:

- Develop a conceptual design for a commercial grass roots hydroliquefaction-based industrial complex including all operations required to mine coal, prepare it by cleaning and washing it, and convert it to ecologically clean liquid and gaseous fuel products. The design should be capable of producing fuels at a price competitive with alternative sources.

- Define the projected product characteristics and marketability.

- Define probable project and financial parameters for design, engineering, procurement, construction, and startup of the complex.

- Estimate the economics for the facility to serve as a guide in making decisions regarding future commercial applications of this technology.

- Provide recommendations regarding additional development effort to foster commercial exploitation of the technology.

1.2 REPORT ORGANIZATION

A summary of the various parts of this report is presented in Section 2 to aid in rapid assimilation of its contents.

Sections 3 and 4 provide an introduction and orientation for the detailed design information presented in later sections. Design parameters and design bases used are summarized in Section 3. Section 4 describes the project scope and major units included in the complex. The relationship of the major operational steps and material flows is presented in the form of a block flow diagram; a plot plan, an artist's rendition of the complex, and a photograph of a model of the complex are also included. Section 5 contains detailed descriptions of the separate units that make up the complex. The process flow diagrams are presented in Section 6.

Sections 7 through 10 present key process efficiency factors and product characteristics/marketability projections. Section 7 summarizes the material balance, and Section 8 presents the projected product characteristics and marketability. The energy balance is given in Section 9, and Section 10 is a detailed utility summary.

A detailed analysis of environmental factors is presented in Section 11. Flow diagrams showing the quantities and compositions of contaminant containing streams plus the facilities and treatments used to remove the contaminants are described in Section 11. Section 12 summarizes plant startup procedures. Section 13 summarizes the major equipment items required, and with the design information previously summarized in the report, provides the basis for the fixed capital investment and operating cost estimates that follow in Section 14. The estimated economics for the complex are developed in Section 14 where fixed capital investment, other capital requirements, operating requirements and operating costs, and projected profitability are presented, accompanied by pertinent sensitivity factors.

The experimental data used as a basis to design the key coal conversion steps are presented in Section 15. Process considerations and predesign studies completed to define the preferred process configuration are given in Section 16.

Finally, Sections 17 and 18 provide a retrospective review of the design. Section 17 presents judgments regarding the expected performance of the plant, and Section 18 points out further potential improvements.