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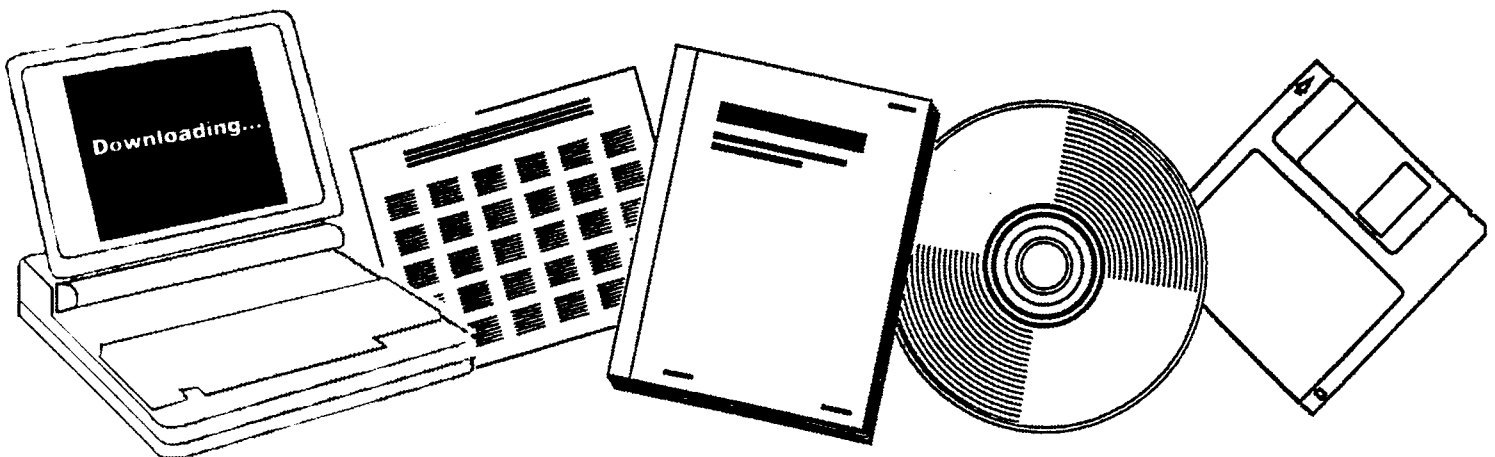
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**PRELIMINARY DESIGN SERVICES COAL
CONVERSION DEMONSTRATION PLANTS. RESEARCH
AND DEVELOPMENT REPORT NO. 114 QUARTERLY
REPORT, JANUARY--MARCH 1976**

PARSONS (RALPH M.) CO., PASADENA, CALIF

APR 1976



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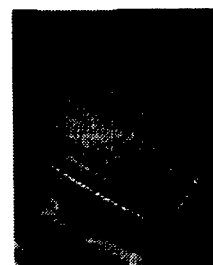
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National Technical Information Service
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**PRELIMINARY DESIGN SERVICES
COAL CONVERSION DEMONSTRATION PLANTS**

**RESEARCH AND DEVELOPMENT REPORT NO. 114
QUARTERLY REPORT
FOR THE PERIOD: JANUARY - MARCH 1976**

Prepared by:

**THE RALPH M. PARSONS COMPANY
100 West Walnut Street
Pasadena, California 91124**

Under Contract No. E(49-18)-1775

April 1976

Prepared for

**ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
WASHINGTON, D. C. 20545**

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FIRST QUARTERLY REPORT
PRELIMINARY DESIGN SERVICES

THE RALPH M. PARSONS COMPANY

I. OBJECTIVE AND SCOPE OF WORK

The objective of the work is to develop preliminary designs and economic evaluations for a number of coal conversion plants. The following designs are included in the scope of work:

- o A conceptual commercial plant for a coal-oil-energy-development (COED) plant.
- o An oil/gas plant to produce liquid fuels plus substitute natural gas (SNG).
- o A commercial-scale Fischer-Tropsch plant with motor fuel and SNG as the main products.
- o A commercial-scale plant for the production of solvent-refined coal (SRC).
- o A coal-oil-gas (COG) refinery to produce clean liquids, gas, and electrical power.
- o A facilities complex capable of demonstrating the commercial feasibility of a variety of coal conversion processes that show promise during pilot plant operations.

The facilities will be considered for conversion of coal to:

1. Low- to high-Btu fuel gas
2. Methanol/motor fuel by Fischer-Tropsch process
3. Clean liquid fuels by alternate liquefaction processes

In addition, supporting efforts will be provided to the above activities. These efforts include planning and progress monitoring, equipment development, and environmental factors.

II. SUMMARY OF PROGRESS TO DATE

A brief synopsis of the status of the major active design efforts is given below, followed by a more detailed reporting on progress for the separate tasks.

The first task, to complete the conceptual design of the COED process and issue the final report, was completed in 1975.

During the past quarter we completed the design of the coal preparation and grinding units for the Fischer-Tropsch complex and advanced the same tasks for the oil/gas complex, including estimates of capital cost and operating expenses. We prepared preliminary reports for these units for use in the ERDA R&D reports which will describe the two designs.

We completed the major portions of the Oil/Gas Plant process design, flow diagrams, heat, material, and energy balances and equipment specifications. We prepared a layout for the complex. Fixed capital cost estimates are underway. We started to assemble material for an economic evaluation of the complex.

We completed the major portion of the Fischer-Tropsch plant process design, flow diagrams, heat, material, and energy balances, and equipment specifications. We generated a layout for the complex. Capital cost estimates for the process units have been initiated.

We continued evaluation of coal liquefaction processes for the COG plant design. This includes technical and economic analyses of candidate processes, preparation of block flow diagrams, material balances, yields and preliminary cost estimates for selected processes.

Efforts to obtain test results for liquid/solids separation and coal feeding devices by means of expellers or extruders, are under way.

We obtained conceptual configurations, capital cost and power requirement estimates for ground coal compression screw feeders from equipment manufacturers.

We continue activities concerning selection of materials of construction for process units and environmental factor support efforts.

III. DETAILED DESCRIPTION OF TECHNICAL PROGRESS

A. Coal Mining/Coal Preparation

1. Objectives.

A long-range objective is to conceptually design and evaluate as feed facilities to conversion plants, coal mine and preparation facilities for five assigned geographic areas where conversion facilities are being studied. Capacities up to 100,000 tons per day are being considered.

2. Activity This Quarter.

We completed the conceptual design and economic evaluation of the 40,000-ton-per-day coal mine and major parts of the related coal preparation plant as feed facilities to be used for the Fischer-Tropsch design. We completed the design of the 50,000-ton-per-day coal mine to serve the Oil/Gas complex and advanced the design of the coal preparation facilities.

B. Oil/Gas Plant Design

1. Objectives.

To develop a preliminary design and economic evaluation for a commercial Oil/Gas plant to produce synthetic liquid fuels and SNG from coal. To define the maximum practical capacity single-train plant using the process.

2. Activity This Quarter.

- a. Dissolver: We completed the material and energy balance, equipment sizing and specifications. We completed the process flow diagram and equipment process specifications. We started equipment engineering specifications.
- b. Dissolver Acid Gas Removal: We completed the process flow diagrams, material balance and process inputs for equipment specifications. We started equipment engineering specification.
- c. Fractionation: We completed the column heat and material balance and the equipment sizing calculations. We completed the process flow diagram and the process input

for equipment specifications. We completed detailed engineering specifications and started estimation of equipment costs.

- d. Naphtha Hydrotreating and Methanation: We completed process process flow diagrams, material balances and equipment sizing and process inputs. We started equipment engineering specifications and completed them for the methanation section. We completed equipment cost estimates for this section.
- e. Gas Treating: We completed process flow diagrams, material balance calculations and process input for equipment specification. We started equipment engineering specifications.
- f. Sour Water Treater: We completed process flow diagrams, material and energy balances and process input for equipment specifications. We completed equipment engineering specification and equipment cost estimates.
- g. Sulfur Plant: We completed the utility requirement calculations, flow diagram, and product quality statement, as well as the capital cost estimates for both process and fuel gas sulfur recovery.
- h. Catalyst and Chemicals: We started to list chemicals and catalyst requirements for the complex. We began a review of all material and energy balances to assure their internal agreement as well as agreement between the separate plant units.

C. Fischer-Tropsch Plant Design

1. Objectives.

To develop a preliminary commercial plant design and economic evaluation for a plant using Fischer-Tropsch technology to produce pipeline gas and motor fuel.

2. Activity This Quarter.

- a. Gasifier: We completed final process flow diagrams and process input to equipment specification. We completed engineering specification of equipment and started equipment cost estimates.
- b. Fischer-Tropsch Synthesis: A consultant reviewed the reactor design and we are evaluating his conclusions. We completed process input for all other equipment specifications and started preparation of the engineering specifications.
- c. Liquid Products Fractionation: We completed the process flow diagram and process input for equipment specifications. We completed engineering specifications of the equipment and started equipment cost estimates.
- d. Water Reclamation Unit: We advanced the process equipment specifications and data sheets.
- e. Oxygen and Sulfur Recovery Plants: We prepared design specifications and capital cost estimates for the oxygen plant, and for sulfur recovery facilities. We completed the process design and process inputs for the gasifier unit.

D. COG Plant Design

1. Objective.

To develop a preliminary design of a coal processing plant that will produce both liquid and gaseous fuels as principal products. The process employed in this plant design shall be the result of an economic selection from the candidate coal conversion processes available.

To develop a model capable of calculating material and heat balances for a number of coal conversion processes using computer capabilities and to estimate the overall utility balance of the complex.

2. Activity This Quarter.

a. We continued to develop costs for individual process units for evaluation estimates.

1. We completed this work for a complex using SRC-type liquefaction with hydrogen feed to the dissolver and non-slurry recycle.

2. H-Coal-based complex.

3. Synthoil-based complex.

4. Hydrogen donor solvent-based complex.

5. COED-based complex.

We further generated block flow diagrams with material and energy balances; also factored capital cost estimates and preliminary economic evaluations for these complexes as

well as for three other SRC-based cases studied during the last quarter of 1975.

b. We advanced comparative process evaluation studies as they apply to the COG design purposes.

1. Oil/Gas Plant complex.
2. Fischer-Tropsch Plant complex.
3. Hydrocarbonization complex.

E. Equipment Development

1. Objective.

To define the equipment and control system development program required to assure reliability and viability of coal conversion processes being developed. To recommend appropriate developmental programs to ERDA - Fossil Energy Division.

2. Activity This Quarter.

a. Gas/Solids Separation: We received additional information on dry and wet electrostatic precipitators design for vacuum service, as well as high-pressure units.

b. Liquid/Solids Separation: We are working with the V. D. Anderson Company to establish a test program for the recovery of solvent from filter cake. We further collaborated with the Votator Division of Chemetron for turbo-film vacuum evaporator unit tests for the same material.

- c. Solids Feed to Gasifier: We have collaborated with the Fuller Company on preparations for testing ground coal compression screw feeding against 150 psi.

F. Materials of Construction

1. Objectives.

To define the preferred materials of construction for use in coal conversion projects.

2. Activity This Quarter.

We developed materials of construction diagram and specifications for the Oil/Gas and Fischer-Tropsch complexes.

G. Environmental Considerations

1. Objectives.

To define environmental factors for proposed coal conversion complexes to define facilities required for the coal conversion complexes to meet environmental standards, and to define product quality standards to meet environmental regulations for product users.

2. Activity This Quarter.

- a. We studied environmental regulations in states where coal conversion facilities could be located and investigated requirements for carbon monoxide emission controls. We investigated water pollution effects of coal ash in preparation for an experimental program.

- b. We visited the SRC facility at Fort Lewis, Washington and reviewed their environmental facilities and procedures.
- c. We reviewed the Fischer-Tropsch Plant design and provided inputs to avoid deleterious environmental plant emissions. We further investigated the products of the complex to ascertain that their use will be ecologically acceptable.

H. General

- 1. During the quarter we presented an invited paper titled "Industrial Energy Usage Patterns" before the American Institute of Plant Engineers (AIPE) Symposium on February 26, 1976 in Seattle, Washington.
- 2. We met with representatives of ERDA in Pasadena on March 28 and 29, 1976 to review the project status.
- 3. We met with a team from the Oak Ridge National Laboratory in Pasadena on March 1, 1976 to consult on equipment design and development problems in coal conversion.

IV. WORK FORECAST FOR THE NEXT QUARTER, APRIL 1 THROUGH JUNE 30, 1976

A. Coal Mining/Coal Preparation

We will complete design and cost estimation work for the Oil/Gas plant coal preparation units.

B. Oil/Gas Plant Design

We will complete the utility balance and process flow diagrams and equipment sizes for the remainder of the complex. We will complete

the capital cost estimate and operating cost estimates for the plant as well as the economic evaluation. We will complete the review draft of the final report.

C. Fischer-Tropsch Plant Design

We will complete the utility balance and all process design work for the facility. We will complete capital and operating cost estimates as well as the economic evaluation. We will complete the review draft of the final report.

D. COG Plant Design

We will prepare a brief text and preliminary economics for determining process design basis. We will advance a design basis for COG plant design. We will prepare a status report on all liquefaction processes currently under evaluation.

E. Equipment Development

We will make contacts to obtain all available information regarding the ERDA program development results for ground coal compression screw feeders and develop judgmental estimates for power requirements and of capital costs.

F. Materials of Construction

We will complete material selection services to the engineering specification of equipment for the Oil/Gas and Fischer-Tropsch designs.

G. Environmental Consideration

We will review all waste disposal processes planned for use in the Oil/Gas and Fischer-Tropsch projects. We will obtain one or more

proposals for a slag/ash leaching study from competent analytical laboratories; this information is required to assure acceptable disposal of slag/ash from the coal conversion complexes.

H. General

We will present the following invited papers:

1. "Preliminary Economic Analysis: Oil and Power by COED-Based Conversion" to the American Chemical Society Symposium on Comparative Economics of Synfuels in New York on April 8, 1976.
2. "Coal Liquefaction; Materials Systems Design" for presentation to the American Society for Metals, in Pittsburgh, Pennsylvania on April 26, 1976.
3. "Coal Conversion Development - An Overview" before the Engineering Institute of Canada (EIC) Conference on May 12, 1976 in Calgary, Alberta.

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