

# 1. INTRODUCTION

Bechtel, along with Amoco as the main subcontractor, developed a Baseline design, two alternative designs, and computer process simulation models for indirect coal liquefaction based on advanced Fischer-Tropsch (F-T) technology for the U. S. Department of Energy's (DOE's) Federal Energy Technology Center (FETC). This study was done under DOE Contract Number DE-AC22-91PC90027.

The objectives of the original 1991 contract were to develop:

- A Baseline design and two alternative designs for indirect liquefaction using advanced F-T technology. The Baseline design uses Illinois No. 6 coal and conventional upgrading and refining. One alternate case uses ZSM-5 upgrading of the vapor stream from the slurry F-T reactor. The other alternate case uses Western coal from the Powder River Basin.
- Capital and operating costs for the Baseline design and the alternatives. Individual plant costs for the alternative cases will be prorated on capacity, wherever possible, from the Baseline case.
- A process flowsheet simulation (PFS) model.

The Baseline design, the economic analysis and PFS computer models formed research planning tools with which PETC could use to plan, guide and evaluate its ongoing and future research and commercialization programs relating to indirect coal liquefaction for the manufacture of synthetic liquid transportation fuels.

The original study was divided into seven major tasks:

- Task 1: Establish the Baseline design and alternatives.
- Task 2: Evaluate the economics for the Baseline and alternate cases.
- Task 3: Develop engineering design criteria.
- Task 4: Develop a process flowsheet simulation (PFS) model for each case.
- Task 5: Perform sensitivity studies using the PFS model.
- Task 6: Document the PFS model and develop a DOE training session on its use.
- Task 7: Perform project management, technical coordination and other miscellaneous support functions.

In 1995, the original study was extended to add the following four additional items

- Item 1: Improve the process flowsheet simulation model (PPS) for the alternative ZSM-5 upgrading case by adding additional components.

- Item 2: Develop another alternative ZSM-5 upgrading case using the Western coal from the Powder River Basin as feedstock.
- Item 3: Develop a case in which fluid catalytic cracking is used to upgrade the F-T wax instead of hydrocracking.
- Item 4: Develop a case in which natural gas instead of coal is used as feedstock for Fischer-Tropsch indirect liquefaction.

In 1996, this study again was extended to investigate another natural gas, Fischer-Tropsch liquefaction case. This case is for a smaller plant processing 100 MMscf/day of natural gas in a once-through mode with power co-production using the proprietary, Fischer-Tropsch, slurry-bed technology of Syncrude Technology, Incorporated.

### Report Organization:

This Final Topical Report contains three major sections. Section 1 provides an introduction and general background of this DOE contract.

Section 2 contains a brief summary of the project. This section is intended only to give an executive summary of the project results. This final topical report is not a comprehensive technical report containing the substantial technical detail developed during the course of the project. Detailed technical information has been previously published in various project reports, technical publications, and conference presentations listed in Appendixes A and B.

Since a significant portion of the effort on this project was devoted to the development of ASPEN Plus process flowsheet simulation models for the various cases and a LOTUS spreadsheet economics model, these models are discussed in the final two parts of Section 2.

Section 3 provides some conclusions and recommendations resulting from this study.

Appendix A contains a listing of the major project reports issued during the execution of this contract. This appendix is divided into four sections containing Topical Reports, Quarterly Reports, Technical Progress Meeting Conference Notes, and selected Letter Reports.

Appendix B contains reprints of all the papers and presentations which were made to DOE sponsored conferences and to the various technical society meetings discussing the results obtained during execution of this contract study.