SECTION 18

POTENTIAL IMPROVEMENTS

A major result of a conceptual design such as that presented in this book is a summary of suggested ways and means of improving future designs.

18.1 DISSOLVER DESIGN

Further experimental studies of required dissolver residence time may lead to a reduction of commercial dissolver size. The dynamics of the reactions in the slurry preheater furnace and in the dissolver vessel merit a thorough study. A possible result is the replacement of the dissolver by a large pipe connecting the furnace to the high-pressure separator.

Another improvement would result from use of a solvent-to-coal ratio as low as 1.5 instead of the more conservative value of 3.0 used in this design. Pilot plant experience indicates that the lower ratio can be used. The predicted economic impacts are reductions of approximately 6, 3, and 5% in fixed capital investments, operating costs, and required product selling prices, respectively.

18.2 SOLIDS SEPARATION

Vacuum filters were specified in this design for removal of unreacted coal and ash from the coal liquids. Prior to this selection, various combinations of hydroclones and centrifuges were considered; all of them led to unacceptably high losses of SRC liquids, which made them uneconomical. Development of reliable and less expensive equipment and procedures for this step would yield significant savings in capital investment and operating and maintenance costs.

Such developments are presently being investigated under ERDA sponsorship and could lead to technical improvements that could be incorporated into future designs.

18.3 DEEP VACUUM DISTILLATION

Reliable test results for distillation of the SRC-II dissolver product under deep vacuum conditions would assist future designs. If such test results show that enough of the liquid can be recovered as distillate to produce a slurry with a maximum of 50% heavy liquid, it might be economically attractive to eliminate the liquid/solids separation and to feed the distillation column bottoms to a gasifier.

18.4 FRACTIONATOR COLUMN PREHEAT

In order to minimize the fractionator preheat furnace duty, and consequently the fuel gas consumption, this design maximizes the fractionator feed to bottoms heat interchange. This approach, in fact, led to an expensive multishell feed to bottoms exchange train. A further refinement of the design may show that a reduction of this exchanger duty and an increase in the furnace duty would present an economically attractive alternative at a very slight reduction of overall thermal efficiency.

18.5 PROCESS DESIGN DATA

The process design is based on the data presently available to us. It is highly desirable to develop further supporting data by more extensive pilot plant investigations of the following major areas:

- Slurry recycle mode of SRC operation at varying pressures, dissolver retention times and temperatures, slurry-to-coal ratios, and other pertinent variables.
- Filter cake drying utilizing hot char or another hot, fine, dry medium (dry filter cake) as heating and drying means.
- Operation of cryogenic separation units using stream compositions cited in the design, with particular attention to phase behavior.

18.6 EQUIPMENT DEVELOPMENT

Certain items of mechanical equipment were included in this design that require further development. The design economics are intended to show the incentive for this development. Successful reduction to practice of these items will advance the commercialization of coal conversion.

Representative desirable developments include:

- Medium- and high-pressure centrifugal coal slurry pumps.
- Medium- and high-pressure dry coal feeders.
- Designs of vacuum filters for high-temperature operation (outboard bearings, seals, etc.).
- Improvements in the field of liquid/solids separation.
- Improvements in the field of gas/solids separation, especially at high pressures and temperatures.
- Increase in the capacity of individual oxygen generation units.
- Utilization of dry fines transport systems at high temperatures using inert gas as the transport medium.

- Methods of operational control of two-stage entrained gasifiers to maintain steady state operation, considering the interaction of coal, char, oxygen, and steam feed variations.