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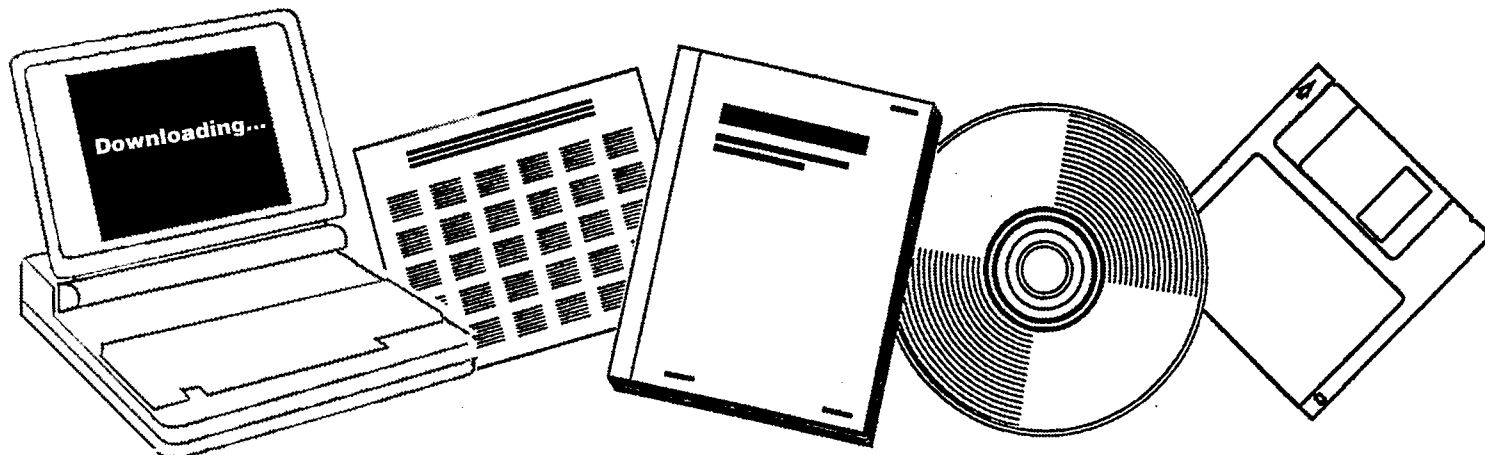
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EVALUATION OF COAL CONVERSION PROCESSES TO PROVIDE CLEAN FUELS. PART II

ELECTRIC POWER RESEARCH INST., PALO
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Final Report
Parts II and III

EVALUATION OF COAL CONVERSION
PROCESSES TO PROVIDE CLEAN FUELS

Final Report

by

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Prepared Under Research Project EPRI 206-0-0 by

THE UNIVERSITY OF MICHIGAN
COLLEGE OF ENGINEERING

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ABSTRACT

A review is made of six general methods of coal utilization with elimination of the sulfur prior to or during combustion in an electric power generating plant:

Fluidized Bed Combustion

Coal Beneficiation

Pyrolysis

Coal Gasification

Coal Dissolution and Liquefaction

In situ Combustion

The processes in each category were reviewed, analyzed and evaluated keeping in mind that they would have to be potentially better than stack gas cleaning processes to be considered as a viable alternative to the electric power industry. Critical process steps, where additional research must be done before the processes can be considered at the commercial stage of development, were identified.

A total of thirty-seven processes were reviewed: five in fluidized bed combustion, one in coal beneficiation, three in pyrolysis, twenty-two in coal gasification and six in coal dissolution and liquefaction. The advantages and disadvantages of the processes were identified. Additional processes are known to exist besides those reviewed. Many of these processes were not reviewed because of the severe time restrictions of the study rather than the merits of the

processes. Other processes were proprietary and not actively seeking outside funding.

Five topics, which are important to coal utilization although not actually coal conversion or utilization processes, are included in Part III. They include discussions of combined cycle systems, economics, retrofit capabilities, thermodynamics and coal slurry pipelines. These topics give perspective to the general subject of coal use.

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FOREWORD

The Task Force on Coal Utilization of the Electric Power Research Institute approached The University in March 1973 to assess the various processes which convert coal to clean fuels or utilize coal in environmentally acceptable ways for electric power generation. A preliminary proposal was submitted to Mr. Larry Simpkin on March 30, 1973 suggesting a 14-month study. After review and discussion, we were advised that EPRI's need was for a study to be completed by January 1974. Accordingly, the final proposal submitted on June 6, 1973, was for one-half the time and budget originally suggested.

The University of Michigan Team received oral reports on the stages of approval of the proposal and started preliminary studies on July 16, 1973. The Board of Directors of EPRI approved the proposal on August 15, 1973. The final contract agreement was signed by EPRI on October 24, 1973 and by The University on November 13, 1973. A news release, approved by EPRI, was issued by the University on August 24, 1973 and is given on page 390.

The seven-month study was very intensive; members of the team had teaching responsibilities for a substantial fraction of their time during the study in addition to the project work.

The results of the study of coal conversion processes were divided into two volumes: Part I and Parts II and III. In this way, the recommendations for support to the Electric Power Research Institute (Part I) are separate from the critical review and assessment of the coal utilization processes being developed in the nation (Part II).

Part I was prepared specifically to assist the Electric Power Research Institute management in the preparation of a long term research program in coal utilization on behalf of the electric power industry. Part I contains the choices and recommendations for research support by EPRI. Those processes which seem to have the best prerequisites for providing clean fuels from coal at the earliest dates were delineated. The bases for and the reasoning behind the choices are given.

Part II contains the process descriptions and general evaluations of some thirty-seven processes which are reviewed. The team of investigators reviewed and studied reports and research proposals for the processes. Personal visits were made to the organizations carrying out the research and development and to the sites where the experiments are being conducted at bench, process equipment development unit and pilot plant stages. The organizations were very cooperative in providing information and generous with their time in answering our questions. Several organizations provided further supporting information requested by telephone or letter after our visits.

The description of the processes is intended to give members of the electrical utility industry an overall understanding of processes and is not intended to transfer detailed technical knowledge in a thorough manner. References are cited for the more complete descriptions available to the team. It is from those references that the information given has been extracted. The understanding developed by the team and documented in Parts II and III of this report provided the basis for the evaluation rendered in Part I.

Part III contains several topics which are important to coal utilization although not actually coal conversion or utilization processes. These topics were added to give greater perspective to the general subject of coal use.

The authors for the several process descriptions or sections are listed. Dr. D.E. Briggs managed and edited the final report.

Donald L. Katz
February 1973

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We acknowledge the time and thoughtful comments freely given by the many individuals in the organizations visited during this project. We appreciate their help sincerely.

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Michael W. Britton
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Edward E. Timm

We hope their experience has been as interesting as ours.