



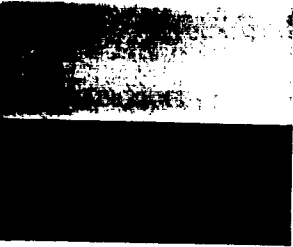
3 2103 00991 5327

**EPRI**

Electric Power  
Research Institute

Topics:  
Coal liquefaction  
Fuel oils  
Synthetic fuels  
Methanol fuels  
Coal  
Coal cleaning

EPRI AP-5043-SR  
Proceedings  
April 1987



# Proceedings: Eleventh Annual EPRI Contractors' Conference on Clean Liquid and Solid Fuels

---

# R E P O R T S U M M A R Y

---

SUBJECTS	Coal-derived liquids / Coal preparation and analysis	
TOPICS	Coal liquefaction	Methanol fuels
	Fuel oils	Coal
	Synthetic fuels	Coal cleaning
AUDIENCE	Fuels engineers / R&D scientists	

---

## **Proceedings: Eleventh Annual EPRI Contractors' Conference on Clean Liquid and Solid Fuels**

The eleventh conference on clean liquid and solid fuels presented some interesting results in the traditional information areas of advanced coal liquefaction, coal-oil coprocessing, and methanol synthesis. Participants at this conference emphasized once-through methanol synthesis for gasification power plants and coal upgrading much more than those at previous conferences.

---

OBJECTIVE	To provide a forum for exchanging information among researchers, EPRI staff, and representatives of utilities and government agencies on the production of clean liquid and solid fuels from coal.
APPROACH	More than 100 conference participants met May 7-9, 1986 in Palo Alto. The 26 presentations included the following topics: <ul style="list-style-type: none"><li>• Advanced coal liquefaction in the United States and Japan</li><li>• Coprocessing of coal and heavy oils</li><li>• Methanol synthesis from CO-rich gas for use in gasifier combined-cycle power plants</li><li>• Coal science, including the structure of subbituminous coal and lignite</li><li>• Coal upgrading, including de-ashing and dewatering of low-rank coal by oil agglomeration and geologic treatment of coals</li><li>• Storage compatibility of fuel oils</li></ul>
KEY POINTS	<ul style="list-style-type: none"><li>• The work on two-stage liquefaction at the Wilsonville, Pennsylvania, Advanced Coal Liquefaction R&amp;D Facility is proceeding well. A report on the early results from close coupling of the two stages indicated that close coupling the reactors increases liquid product yield.</li><li>• Bench-scale tests on coprocessing of coals and heavy residua suggest that coprocessing is an attractive option to coal liquefaction or heavy oil upgrading alone. Coprocessing is also a promising route for early introduction of coal-derived fuels into the marketplace.</li></ul>

---

- 
- Technology development for partially converting synthesis gas to methanol in an integrated-gasification-combined-cycle power plant is maturing. Papers described work at scales ranging from the laboratory through planning for a 35-t/d demonstration.
  - Oil agglomeration appears to be a good way to dewater low-rank coals.
  - Biologic coal conversion is progressing at a rapid pace.
- 

PROJECT EPRI Project Manager: Howard E. Lebowitz  
Advanced Power Systems Division

---

For further information on EPRI research programs, call  
EPRI Technical Information Specialists (415) 855-2411.

Proceedings: Eleventh Annual EPRI Contractors'  
Conference on Clean Liquid and Solid Fuels

---

AP-5043-SR

Proceedings, April 1987

Palo Alto, California  
May 7-9, 1986

Conference Organizer  
H. E. Lebowitz  
Electric Power Research Institute

Sponsored by

Electric Power Research Institute  
3412 Hillview Avenue  
Palo Alto, California 94304

EPRI Project Manager  
H. E. Lebowitz

Fuel Science and Conversion Program  
Advanced Power Systems Division

#### ORDERING INFORMATION

Requests for copies of this report should be directed to Research Reports Center (RRC), Box 50490, Palo Alto, CA 94303, (415) 965-4081. There is no charge for reports requested by EPRI member utilities and affiliates, U.S. utility associations, U.S. government agencies (federal, state, and local), media, and foreign organizations with which EPRI has an information exchange agreement. On request, RRC will send a catalog of EPRI reports.

Electric Power Research Institute and EPRI are registered service marks of Electric Power Research Institute, Inc.

Copyright © 1987 Electric Power Research Institute, Inc. All rights reserved.

#### NOTICE

This report was prepared by the Electric Power Research Institute, Inc. (EPRI). Neither EPRI, members of EPRI, nor any person acting on their behalf: (a) makes any warranty, express or implied, with respect to the use of any information, apparatus, method, or process disclosed in this report or that such use may not infringe privately owned rights; or (b) assumes any liabilities with respect to the use of, or for damages resulting from the use of, any information, apparatus, method, or process disclosed in this report.

## ABSTRACT

EPRI's Eleventh Annual Contractors' Conference on Clean Liquid and Solid Fuels was held on May 7-9 1986 in Palo Alto, California. The Conference featured results of work on coal science, coal liquefaction, methanol production, coal oil coprocessing and coal upgrading.

## PREFACE

The Clean Liquid and Solid Fuels Contractors' Conference was held on May 7-9, 1986 in Palo Alto, California. Presentations were given in the following areas:

- Two-stage liquefaction of coal in the United States and Japan
- Synthesis of methanol from CO-rich gas for use in gasifier combined-cycle power plants
- Coal science, including the structure of subbituminous coal and lignite
- Coal upgrading, including de-ashing and dewatering of low-rank coal by oil agglomeration and geological treatment of coals
- Coprocessing of coal and heavy oils
- Storage compatibility of fuel oils

## CONTENTS

<u>Section</u>	<u>Page</u>
1 COAL LIQUEFACTION	1-1
Effect of Coal Properties on EDS Economics G. Melin and L. Castiglioni Exxon Research and Engineering Company	1-1
Multistaged Catalytic Process Development for Coal Liquefaction M. A. Pacheco and A. M. Tait Amoco Oil Company	1-27
Two-Stage Coal Liquefaction Process Performance with Close Coupled Reactors in Wilsonville C. W. Lamb, J. M. Lee and R. V. Nalitham, Catalytic, Inc. and T. W. Johnson, Southern Company Services	1-43
Wilsonville Process Studies and Engineering Evaluation of Improved Options J. R. Gough, W. R. Hollenack, C. W. Lamb and R. V. Nalitham Catalytic, Inc.	1-89
Utilization of Hydrogen During Coal Liquefaction B. C. Bockrath, D. H. Finseth and E. G. Illig U. S. Department of Energy, Pittsburgh Energy Technology Center	1-139
Two-Stage Liquefaction Coal Derived Liquid as a Combustion Turbine Fuel K. L. Rieke and H. G. Lew Westinghouse Electric Corporation	1-155
2 COAL UPGRADING AND RESEARCH	2-1
Selective Oxidation of Coal Pyrites In Coals By Steam/Air Mixtures in a Fluidized Bed J. H. Oxley, H. E. Carlton and J. Klingspor Battelle Columbus	2-1
Oil Agglomeration of Low-Rank Coals and Development of Methods for Recovery of Oil from Agglomerates L. Ignasiak, W. Pawlak, A. Turlak, J. Janiak and Y. Briker Alberta Research Council	2-13
Microbial Beneficiation of Low-Rank Coals B. Wilson, J. Pyne, R. Bean, D. Stewart, J. Frederickson, E. Sass and M. Burnside Battelle Pacific Northwest Laboratory	2-45



<u>Section</u>	<u>Page</u>
Microbial Degradation of Coal by Polyporus Versicolor: Metabolism and Product Characterization M. Cohen and H. Aronson University of Hartford	2-63
Chemical Structural Differences Between Two Low-Rank Coals I. Goldberg and K. E. Chung Rockwell International	2-81
<b>3 METHANOL PRODUCTION</b>	<b>3-1</b>
The Development of Liquid Phase Methanol Process: An Update T. R. Tsao and P. Rao Air Products and Chemicals, Inc.	3-1
Methanol Co-production for Electric Utility Applications J. F. Weinhold Tennessee Valley Authority	3-47
IGCC Criteria for Once-Through Methanol Using the LPMEOH Process R. L. Mednick, Chem Systems and T. L. Wright, H. M. Weatherington and J. Pech, Tennessee Valley Authority	3-63
Low Temperature Methanol Process: The Next Step R. Sapienza Brookhaven National Laboratory	3-93 ✓
Research on Once-Through Methanol S. Lee, V. Parameswaran, A. Sawant, M. Ko and D. H. Cho University of Akron	3-105
Project Development of a Commercial Coal-Oil Coprocessing Plant R. H. Shannon Ontario-Ohio Synthetic Fuels, Inc.	3-141
<b>4 COAL OIL CO-PROCESSING</b>	<b>4-1</b>
Single Stage Processing of Coal/Resid Mixture M. Humbach and C. P. Luebke, Universal Oil Products and J. G. Gatsis and B. J. Nelson, The Signal Research Center, Inc.	4-1
HRI's Coal/Oil Co-processing Program - Phase I J. B. MacArthur, J. E. Duddy and J. B. McLean Hydrocarbon Research, Inc.	4-17
Co-processing of Wyodak Subbituminous Coal and Colorado Shale Oil R. L. Miller and R. M. Baldwin Colorado School of Mines	4-49
Stability and Compatibility of Residual Fuel Oils R. Anderson, J. Goetzinger and J. Reynolds National Institute for Petroleum and Energy Research (NIPER)	4-87

<u>Section</u>	<u>Page</u>
5      GENERAL SESSION	5-1
TVA's Gas Processing Experience in Support of Methanol Production from Coal	5-1
P. C. Williamson, L. E. Daniels and D. A. Kelley Tennessee Valley Authority	
Chemistry and Uses of Carbon Dioxide	5-21
I. Wender University of Pittsburgh	
Structure and Reactivity of a Wyodak Subbituminous Coal	5-53
R. Narayan and S. Huang Purdue University	
Differing Reactivity of Oxygenated Model-Coal Structures in Hydrogen-Donor and COH <sup>2</sup> O System	5-75
D. F. McMillen, R. Malholtra, S. E. Nigenda, T. C. Min and D. S. Ross SRI International	
APPENDIX A      AUTHORS	A-1