



UMR-MEC Conference on Energy

---

01 Jan 1974

## Front Matter

University of Missouri--Rolla

Follow this and additional works at: <https://scholarsmine.mst.edu/umr-mec>

 Part of the [Chemical Engineering Commons](#), and the [Chemistry Commons](#)

---

### Recommended Citation

University of Missouri--Rolla, "Front Matter" (1974). *UMR-MEC Conference on Energy*. 2.  
<https://scholarsmine.mst.edu/umr-mec/2>

This Conference proceedings is brought to you for free and open access by Scholars' Mine. It has been accepted for inclusion in UMR-MEC Conference on Energy by an authorized administrator of Scholars' Mine. This work is protected by U. S. Copyright Law. Unauthorized use including reproduction for redistribution requires the permission of the copyright holder. For more information, please contact [scholarsmine@mst.edu](mailto:scholarsmine@mst.edu).

Extension Division

**ENERGY RESOURCES  
AND  
MANAGEMENT**

edited by

JOSEPH T. ZUNG

DEPARTMENT OF CHEMISTRY  
UNIVERSITY OF MISSOURI - ROLLA

1974

*UMR-MEC Conference on Energy Resources 1st...*

UMR EXTENSION DIVISION

*TJ  
153  
.U5  
1974*

ENERGY RESOURCES  
=  
AND  
MANAGEMENT

BASED ON THE FIRST UMR-MEC CONFERENCE ON ENERGY RESOURCES  
HELD AT ROLLA, MISSOURI, APRIL 24-26, 1974 ON THE OCCASION  
OF THE DEDICATION OF THE NEW CHEMISTRY AND CHEMICAL ENGINEER-  
ING BUILDING

*Gift -*

EDITED BY

JOSEPH T. ZUNG

DEPARTMENT OF CHEMISTRY  
UNIVERSITY OF MISSOURI-ROLLA

1974

**240631**

RECEIVED FEB 28 1975

GH  
3-27-75

Copyright © 1974

The University of Missouri  
Rolla, Missouri  
Department of Chemistry and  
Extension Division

All Rights Reserved

PRINTED IN THE UNITED STATES OF AMERICA

# **First UMR-MEC Conference**

  

## **on Energy Resources**

**April 24-26, 1974**

**University of Missouri - Rolla**

**Presented by:** The Governor's Missouri Energy Council (MEC)  
University of Missouri - Rolla Departments of  
Chemistry and Chemical Engineering and Extension  
Division

**In Cooperation with:** The American Chemical Society, South Central  
Missouri Section  
The American Institute of Chemical Engineers, St.  
Louis Section  
The American Nuclear Society, Kansas-Missouri  
Section  
Institute of Electrical & Electronic Engineers, St. Louis  
and Kansas City Chapters

**Conference Chairman:** Dr. Bill L. Atchley, Chairman  
Governor's Missouri Energy Council (MEC)

**Program Chairman:** Dr. Joseph T. Zung, Professor of Chemistry  
University of Missouri - Rolla

## CONTENTS

|   |     |
|---|-----|
| Preface .....   | VI  |
| Introductory Remarks, Joseph T. Zung, .....   | 1   |
| <u>PART I: ENERGY RESOURCES</u>   |     |
| <u>I - Plenary Session</u> , Co-chairmen: William H. Webb and Joseph T. Zung  |     |
| Conference keynote address: John B. Rigg, Deputy Assistant Secretary of the Interior, U. S. Department of the Interior, .....   | 4   |
| <u>II - Nuclear Energy</u> , Chairman: Albert E. Bolon  |     |
| Prospects for Nuclear Fusion Power, William C. Gough, U.S. Atomic Energy Commission, Washington, D.C. 20545 .....   | 7   |
| Alternate Energy Removal Modes for Nuclear Power Reactors, Robert L. Carter, College of Engineering, University of Missouri - Columbia .....  | 13  |
| Are Nuclear Shipments Really Safe?, William A. Brobst, Chief, Transportation Branch, Division of Waste Management and Transportation, U.S. Atomic Energy Commission, Washington, D.C. 20545 ..... | 21  |
| Radiation Testing Under Simulated Loka Conditions, K. G. Mayhan, D. R. Edwards & W. F. Oberbeck, University of Missouri - Rolla, and J. F. Montle, Carboline Company, St. Louis, Missouri .....   | 29  |
| Locating Nuclear Power Plants Underground, Frank M. Scott, Harza Engineering Company, Chicago, Illinois .....   | 30  |
| <u>III - Solar and Wind Energy</u> , Co-chairmen: Daniel K. Ai and Jack L. Boone  |     |
| Introduction, Dr. Jack L. Boone.....  | 39  |
| Prospects for Conversion of Solar Energy Into Electrical Power, William R. Cherry, NASA, Goddard Space Flight Center .....  | 40  |
| The U. S. Wind Power Program, Joseph M. Savino, NASA, Lewis Research Center .....   | 43  |
| Solar-Thermal Energy Conversion, Dr. E. R. G. Eckert, University of Minnesota .....   | 46  |
| A Solar-Hydrogen Energy Conversion Scheme for Agricultural Use, R. L. Reisbig, J. L. Boone, G. E. Weiss, T. Van Doren, Engineering Research Laboratory, University of Missouri - Rolla .....      | 47  |
| Flat Plate Collector Design for the Central U. S., Joseph T. Zung, Department of Chemistry, University of Missouri - Rolla .....  | 63  |
| <u>IV - Chemical Energy</u> , Chairman: James L. Gaddy  |     |
| The Energy Problem - Crude Oil, J. A. Marshall, Shell Oil Company, Wood River, Illinois .....   | 65  |
| The Role of Natural Gas and LNG in Supplying Our Energy Needs, D. L. Caldwell, J. F. Pritchard & Company, Kansas City, Missouri .....   | 75  |
| Oil Shale and Its Potential Utilization, G. U. Dinneen, Laramie Energy Research Center, Bureau of Mines, U. S. Department of the Interior, Laramie, Wyoming .....                                 | 79  |
| Coal and Its Derivatives as an Energy Resource, W. G. Stockton, Vice President, Public Relations & Traffic, Peabody Coal Company .....  | 86  |
| Coal Gasification and Liquefaction, Sam Friedman, Assistant Research Supervisor, Pittsburg Energy Research Center, U. S. Bureau of Mines, Pittsburg, Pennsylvania .....                           | 90  |
| Hydrogen - An Emerging Energy Carrier, James E. Funk, College of Engineering, University of Kentucky, Lexington, Kentucky .....   | 91  |
| Energy From Biochemical Sources, G. J. Fennewald, D. L. Million, E. L. Park and J. L. Gaddy, University of Missouri - Rolla .....   | 94  |
| Status and Outlook for Energy Conversion Via Fuel Cells, John P. Ackerman, Argonne National Laboratory, Argonne, Illinois .....   | 98  |
| Oxidation Reactions of Unsaturated Hydrocarbons for Fuel Cells, J. W. Johnson and W. J. James, University of Missouri - Rolla, and A. K. Agrawal, Ohio State University, Columbus, Ohio 43210 ... | 102 |

|  |     |
|--|-----|
| Energy Saving Projects Recently Completed at a Large Petroleum Refinery, J. A. Marshall and A. D. Kiehne, Shell Oil Company, Wood River, Illinois .....  | 108 |
| V - <u>Mining and Petroleum</u> , Co-chairmen: John P. Govier and James J. Scott   |     |
| An Overview of Natural Gas Supply and Availability, D. E. Gibbs, Panhandle Eastern Pipe Line Company, Liberal, Kansas .....  | 114 |
| Bellamy Field Tests: Recovery of Medium Gravity Crude Oil From Missouri Tar Sands by Counterflow Underground Burning, J. C. Trantham, Phillips Petroleum Company .....   | 118 |
| Oil Spill Containment and Removal in Arctic Ecosystems, Wilfred R. McLeod and Diana L. McLeod, Marathon Oil Company, Houston, Texas .....  | 135 |
| Missouri Coal in Perspective, Charles E. Robertson, Missouri Geological Survey & Water Resources, Rolla, Missouri .....  | 145 |
| A Technique for Improving Stability of Petroleum Reservoir Simulation Models, M. D. Arnold, T. C. Wilson and A. Herbert Harvey, University of Missouri - Rolla .....   | 148 |
| VI - <u>Energy Systems</u> , Chairman: J. Derald Morgan  |     |
| Power Transmission Technology for the 1980-1990 Time Period, T. H. Lee, General Electric Company, Philadelphia, Pennsylvania.....  | 154 |
| A Systems Approach to the Design of a Hydrogen Economy, Joel Hebert, Department of Mechanical and Aerospace Engineering and Materials Science, Rice University, Houston, Texas .....   | 162 |
| Development of the Solid Waste Resource, David L. Klumb and Earl M. Wells, Union Electric Company, St. Louis, Missouri .....   | 169 |
| A Proposed Coal Slurry Pipe Line, R. W. Toler, Arkansas Power & Light Company, Pine Bluff, Arkansas .....  | 177 |
| Clean Fuel from Coal for Electric Power Generation, J. Agosta, Commonwealth Edison Company .....   | 179 |
| The Associated Electric Cooperative Energy Control System, Douglas W. Arlig, Associated Electric Coop., Inc., Springfield, Missouri .....  | 183 |
| <u>PART II: ENERGY MANAGEMENT</u>  |     |
| VII - <u>Environmental Impacts of Power Generator Stations</u> , Chairman: Joseph T. Zung  |     |
| Energy and the Environment, Joseph T. Zung, Department of Chemistry, University of Missouri-Rolla ..   | 192 |
| The Assessment of Environmental Impacts at Nuclear Power Generating Stations, Thomas H. Row and J. R. McWherter, Environmental Statements Project, Oak Ridge National Laboratory, P.O. Box X, Oak Ridge, Tennessee 37830 ..... | 194 |
| History of SO <sub>2</sub> Removal System at the Meramec Plant of Union Electric, Gerald E. Dreifke, John F. McLaughlin, and Jerrel D. Smith, Union Electric Company, St. Louis, Missouri .....                                | 195 |
| Interfaces of Steam Electric Power Plants with Aquatic Ecosystems, Gerald J. Lauer, William T. Waller and Guy R. Lanza .....   | 198 |
| An Environmental and Energy Information System, G. U. Ulrikson, M. P. Guthrie, G. M. Caton and H. F. McDuffie, Oak Ridge National Laboratory, Oak Ridge, TN 37830 .....  | 211 |
| VIII - <u>Industrial Energy Management</u> , Co-chairmen: G. R. Cuthbertson and B. R. Sarchet  |     |
| Future United States Energy Demand Patterns, Leland Blank, Industrial Engineering, University of Texas - El Paso and Richard Riley, Mechanical Engineering, University of Missouri - Rolla .....                               | 215 |
| An Advanced Supervisory Indication, Control & Data Acquisition System, George W. Fox, Union Electric Company, St. Louis, Missouri .....  | 221 |
| Mini-Computer Control of Electrical Energy Demand, Thomas P. Hertel, Meramec Mining Company, Sullivan, Missouri .....  | 234 |
| Auditing Program for Effective Energy Conservation, S. Noble Robinson, Mallinckrodt Chemical Works, St. Louis, Missouri 63147 .....  | 235 |

|  |     |
|--|-----|
| Monitoring and Control of Electric Power Usage, Robert B. Webb, Armco Steel Corporation, Kansas City, Missouri .....   | 239 |
| Monsanto's Energy Conservation Program, Ray E. Doerr, Engineering Director, Corporate Energy Conservation Program, Monsanto Company, St. Louis, Missouri ..... | 240 |
| Energy Conservation in the Manufacturing Process, Paul H. Kaiser, Emerson Electric Company .....   | 242 |
| Uniroyal's Approach to Energy Management, J. C. Madigan, Director, Operations Analysis, Corporate Engineering Uniroyal, Inc., Middlebury, Connecticut .....    | 246 |
| Energy Conservation: Constructive But No Cure, N. V. Poer, General Motors Corporation, Detroit, Michigan .....   | 251 |
| Development of Industrial Energy Management Programs, Michael C. Noland, Midwest Research Institute, Kansas City, Missouri .....                               | 254 |



## PREFACE

This book is a collection of the technical papers presented at the First UMR-MEC Conference on Energy Resources held at Rolla, Missouri April 24-26, 1974. The conference was organized jointly by the Missouri Energy Council (MEC) and the faculty of the University of Missouri-Rolla (UMR) in conjunction with the dedication of the new Chemistry and Chemical Engineering building. It was intended to provide the public with some basic information regarding the energy resources and the new methods of conserving our precious and increasingly scarce supply of energy.

The energy crisis is fundamentally a technological problem and the only source of workable answers to this problem must come from new advances in research for new sources of energy and new methods for energy management and conservation. At present, we are now exploiting many of the benefits of science and engineering to alleviate the energy crisis: nuclear power plants with improved effectiveness, more sophisticated systems-control methods to improve reliability of electric power, etc. In the future, there remains a huge responsibility for the scientist and the engineer to do all he can to find new ways of finding, converting, delivering and using energy more efficiently.

The message delivered by various authors of this book clearly emphasizes the key role played by the scientist and the engineer in finding potential technological solutions to the present energy crisis:

- To find new kind of fuels, new energy resources not now being used, such as nuclear fusion, solar energy, tidal energy, geothermal energy.
- To find enlarged sources of present fuels and improved ways to locate and extract them.
- To improve on presently available fuels, such as cleaner oil, cleaner coal and more effective means of enriching uranium.
- To improve energy conversion techniques for higher efficiency, less waste, and fewer environmental detrimental impacts.
- To improve transmission and power delivery systems for better efficiency and safety.
- To improve efficiency in energy useage, more efficient engines, more effective use of waste heat.

I am sure that the papers presented here will not help us solve all of our energy problems, but at least they will inform the reader on many aspects of energy resources and conservation. From the discussions of this Conference, a gigantic body of information has been collected. On this information, we can now base our assessment not only of the natural resources of the nation and the earth, but also of the likely future demands on them and of their deeper societal implications. Through a full and close cooperation between the academic community, the industries, and the State and Federal Government, we must continue to learn about what we have, how to estimate it, and how to manage it in the best interests of the nation.

The role of the academic community is mainly in education and research. In the field of education, through courses and degree programs, the university must be concerned with the education of the general public on the various effective measures for conserving our energy resources. It must also educate people to understand the conflicting aspects of energy supplies and the quality of our environment, to convince them that we must continually match our needs and desires for additional energy with our ecological hopes and dreams. In its educational role, the academic community must also strive to train competent energy experts, scientists, engineers, sociologists, economists, and even politicians, well versed in the intricate complexities of the energy field. In the research arena, the academic institutions must be fully committed to carry out basic research in all fields of energy resources and conservation. This research program may be carried out under existing structure of the academic institutions or be centralized in a more or less autonomous Center for Energy Research and Development.

On the national level, we need a firm set of guidelines set up through a high-level group of broadly qualified specialists. These guidelines should be sanctioned by Congress and Federal Government as our National Energy Policy.

On the international level, since the conditions affecting energy resources are constantly changing, thus affecting both national and international welfare, we need to set up an international review and warning system to monitor these changes in such a way that crises of supply or environmental degradation can be foreseen and avoided.

The editor