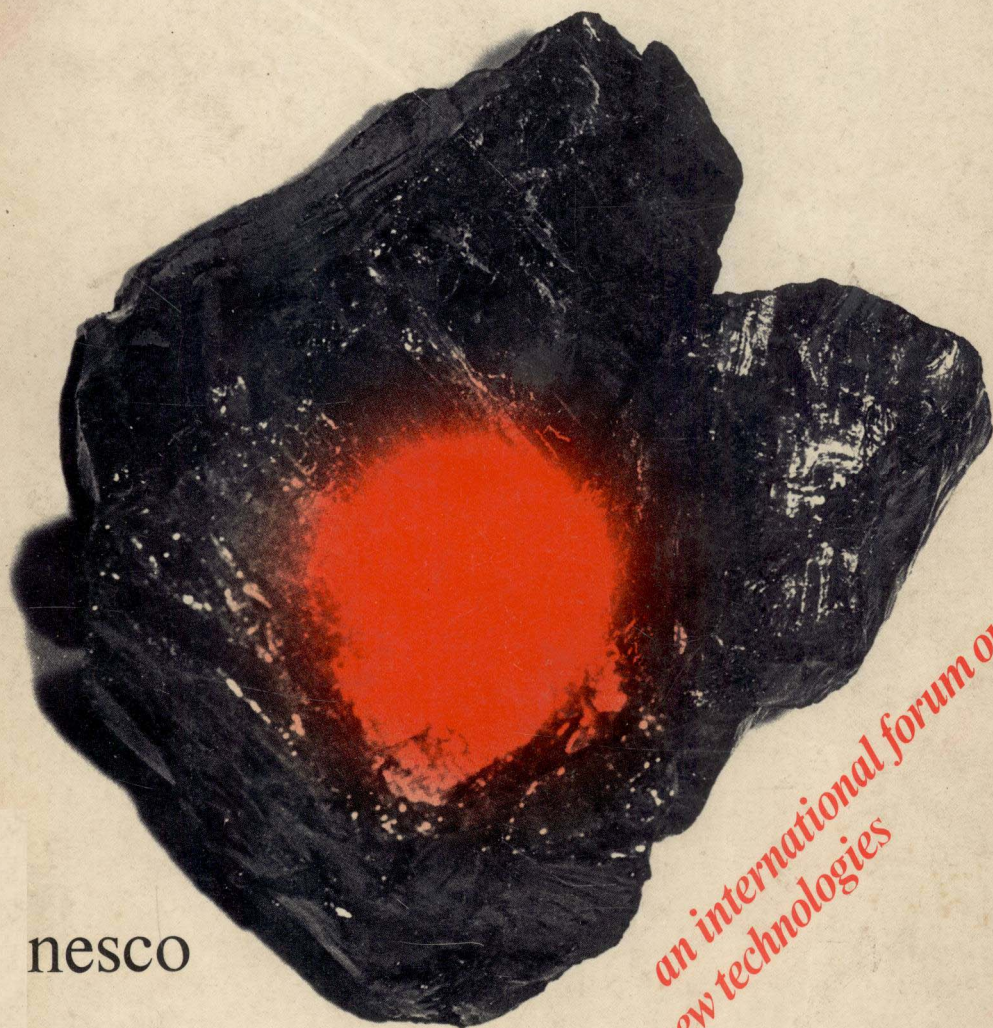


# COAL

## utilization



nesco

*an international forum on  
new technologies*

Coal utilization



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on new technologies

Unesco

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# Preface

The International Forum on New Technologies of Coal Utilization, which took place from 25 to 29 January 1982 in Essen, Federal Republic of Germany, was part of the series of International Forums on World Energy Problems organized within Unesco's interdisciplinary energy programme and aimed at the development of different energy sources.

The first Forum took place in Paris in December 1975 and was devoted to the discussion of scientific and technological problems pertaining to future energy supplies, and especially of ways to achieve more efficient utilization of existing energy sources, including conventional and non-conventional ones.

The second Forum, held in Santiago de Compostela, Spain, in June 1979, gave specific attention to the potential role of fusion and solar energy in meeting world energy needs.

The theme of this Forum was chosen after consultations and discussions with major international organizations involved in the promotion and development of international and regional co-operation in the energy field.

The main purpose of the Forum was to discuss and evaluate impartially, from technical and socio-economical points of view, the prospects of new technologies of coal utilization, e.g. production of synthetic gas and oil from coal, new methods of coal combustion, coal-fired magnetohydrodynamic (MHD) installations, etc. Special attention was given to the problems of coal utilization in developing countries.

Unesco wishes to express its gratitude to the National Commission for Unesco of the Federal Republic of Germany and to the Bergbau-Forschung GmbH for their willingness to host the International Forum on New Technologies of Coal Utilization in Essen,

as well as to the United Nations Industrial Development Organization for its co-operation in the organization and conducting of the Forum. Thanks are expressed also to Professor W. Peters and Dr H. D. Schilling of the Bergbau-Forschung GmbH for their extensive organizational efforts and intellectual contribution to the Forum.

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# Summary statement 1

In the light of the present situation, it is clear that all energy options must be pursued vigorously, including coal utilization which, given the relatively large resources available, is considered to be one of the major options for the next few hundred years.

The Forum reviewed the status of the alternative technologies of coal utilization, including direct combustion, gasification, liquefaction and magnetohydrodynamic (MHD) electricity generation.<sup>1</sup> These options were discussed in terms of the most recent technological progress, economic prospects and environmental impact. The outstanding issues were covered from the points of view of both the industrial and the developing countries.

The participants agreed that throughout the world direct combustion is the simplest way to utilize coal and the most widely used alternative. With growing demand, coals with a wider variety of characteristics will have to be employed, and increasing efforts are called for to improve efficiency according to local circumstances. This includes the need for accurate knowledge of the physical, chemical and petrographic characteristics required for the selection of the appropriate processes and equipment, and the evaluation of the economic and environmental impacts.

The direct-combustion alternatives discussed included burning of pulverized steam coal in electric power plants, utilization of coal-oil mixtures (COM) and fluidized-bed combustion of coal. Of these, the most promising technology appears to be fluidized-bed combustion.

The discussions also emphasized the need to give necessary

1. Additional information on these processes as well as on technical terms used in the statement can be found in the perspective parts of the supporting report.

consideration to the production of gas from coal, since such gas constitutes a versatile feedstock and energy carrier, as low Btu gas for local consumers or as a higher Btu gas for long-range distribution. The available processes comprise fixed-bed, fluidized-bed and entrained-bed configurations, and the Lurgi, Winkler and Koppers-Totzek processes are commercially available. Development targets over the short term are to increase efficiency, extend the range of applications to a wider variety of coal, and to improve the overall competitiveness.

The current status of various coal-liquefaction techniques was discussed in detail. Considerable research and development continues to be carried out in various industrial countries. While these processes are promising over the long term, there appeared to be a consensus that the currently published schedules for commercial production of synthetic liquids are somewhat optimistic and that significant production before 1990 cannot realistically be expected.

The R&D programmes related to electricity production from MHD using coal in power stations and in co-generation plants were reviewed. This process, employing a simple direct coal-combustion technique or clean fuel produced from coal by gasification or pyrolysis, appears to hold promise, but it is too early to judge its commercial viability.

From the environmental point of view, it was agreed that the introduction of new technologies will tend to reduce the impact of coal utilization on nature and human health. However, a careful effort will have to be made to include the hidden costs relating to environmental protection in economic evaluations of the various processes.

With respect to issues of greatest interest to the developing countries, it was clear that the problems of local coal characterization and enhancement of the technical manpower capability are most important over the short term. Improved information exchanges both with industrial and with developing countries are required. Support of small-scale R&D projects in the developing countries should be promoted as one of the best ways to establish a sound technical manpower base. Over the short term it may become justified for some of the developing countries to lead in the establishment of a few large-scale coal-utilization projects for domestic use or export. For the more advanced utilization processes, regional and international co-operation might be an important contributing factor.

Finally, all the participants emphasized that, notwithstanding the problems associated with large-scale utilization of new technologies, coal is now and will continue to be in the future an

increasingly important contributor to the energy-resource mix for both industrial and developing countries. It is important to speed up progress in achieving better coal utilization, and international as well as regional co-operation should be promoted.



# Introduction

## 2

### General background

The Third International Forum on Fundamental World Energy Problems, devoted to new technologies of coal utilization, was organized by Unesco in co-operation with the United Nations Industrial Development Organization (UNIDO) in Essen, 25–29 January 1982, at the invitation of the Government of the Federal Republic of Germany and with the support and assistance of the Bergbau-Forschung GmbH. The Forum was held on the premises of the latter organization.

The Forum was intended to contribute to a better understanding of the perspectives of coal utilization with a view towards meeting the growing world energy demand.

The Forum brought together some twenty-five specialists in coal R&D in their private capacities, plus a number of observers from interested organizations. The list of participants is given in Appendix B. Background documents were circulated to participants and a number of papers were presented at the Forum.

Participants in the Forum were requested to prepare:

1. A summary statement, intended for a wide public, on the perspectives of new technologies of coal utilization.
2. A supporting report giving scientific and technological information, including a description of progress made in scientific research, engineering and technology, and the socio-economic and environmental aspects of these methods of coal utilization.

## Opening of the Forum

At the opening session on 25 January the group was addressed by the Executive Managing Director of the Bergbau-Forschung GmbH, Mr W. Peters, who welcomed the group to Essen and thanked Unesco and the National Commission for Unesco of the Federal Republic of Germany for the initiative to convene this conference at the Bergbau-Forschung GmbH. In his speech he pointed out the importance of coal as one of the major energy sources at the present time and the role it is expected to play in the future.

There followed an address by Mr F. Precht, representative of the National Commission, who also welcomed the participants and observers at the Forum and emphasized the leading role of Unesco in developing international scientific co-operation aimed at the solution of crucial problems facing mankind, like the energy problems.

In turn, Mr T. Beresovski, of the Unesco Secretariat, welcomed the participants on behalf of the Director-General of Unesco. Mr Beresovski pointed out that Unesco expected the Forum to generate important documentation on coal utilization that might provide increased understanding, stimulate further reflection, and be useful to energy planners and decision-makers in many places and countries.

Mr Beresovski also expressed the hope that special attention would be given to the problems of coal utilization in developing countries, many of which face perhaps more serious energy problems than the industrial ones, and some of which have potentially important coal resources.

Mr M. Maung of UNIDO also addressed the group, calling attention to the problems of coal utilization in developing countries. He stressed the importance of scientific and technical co-operation between developed and developing nations in this important field.

## Organization of the work of the Forum

At the first working session it was proposed and unanimously agreed that Mr H. Messerschmidt should serve as Chairman of the Forum and that he would be assisted by Messrs M. Styrikovich, F. Goldner and R. Badilla-Ohlbaum as the Vice-Chairmen who would chair the discussion sessions.

Messrs P. F. M. Paul and A. J. Forney were elected by the participants as Chief Rapporteurs.

Mr Messerschmidt, as Chairman of the first working session, opened the technical discussions and stressed the importance of the meeting, especially in view of the present energy situation. In his speech he thanked Unesco for the decision to convene this Forum in the Federal Republic of Germany and, in particular, at the Bergbau-Forschung GmbH, which is vitally interested in progress in this field.

Finally, two overview papers, presented by Mr H. D. Schilling and Mr Forney, completed the proceedings of the first working session.

The Forum devoted four sessions to technical discussions of the following technologies of coal utilization: coal gasification, coal liquefaction, new methods of coal combustion, and coal-fired MHD installations.

One session was devoted to environmental aspects of coal utilization. A special session was organized to provide for the presentation of reports on national coal-research programmes of both developed and developing countries as well as for statements of international organizations.

At each session discussion was initiated by the presentation of papers prepared by participants on specific subjects, and was followed by question-and-answer discussions involving all participants. The summary papers presented at the sessions are given in Appendix A.

In the course of the Forum special visits to research and industrial coal facilities located near Essen were organized for participants.

## **Closing of the Forum**

The closing session of the Forum was devoted to the discussion of the Summary Statement, and its Supporting Report. These documents were unanimously adopted by the participants.

Mr H. D. Schilling on behalf of the Chairman of the Forum and Mr T. Beresovski on behalf of the Unesco Secretariat thanked the participants for their contributions and expressed their belief that this meeting had contributed to a better understanding of the prospects of new coal technologies.

