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M E M O R A N D U M

CONCERNING THE IMPLEMENTATION AND EXECUTION OF A COAL RESEARCH
PROGRAMME WITH A VIEW TO OBTAINING FINANCIAL AID UNDER THE
TERMS OF ARTICLE 55 § 2 c) OF THE ECSC TREATY

(Budgetary year 1983)

(submitted to the Council by the Commission)

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CONCERNING THE IMPLEMENTATION AND EXECUTION OF A COAL RESEARCH PROGRAMME
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I. INTRODUCTION

Support for research and development projects as well as for other actions in the energy sector (energy saving, production and utilization of various energy sources including coal, etc.) forms part of the Community's energy strategy and of the energy policies of the Member States.

The Commission has, on many occasions, stressed the importance of coal research as one of the means of contributing towards the attainment of the energy objectives set by the Community, particularly that of reducing the Community's dependence on oil. Moreover, the Commission attaches the highest value to Community research.

In its Communication to the Council "The rôle for coal in Community energy strategy"*, the Commission made several clear statements about coal research, emphasising the active rôle that should be played by the Community in promoting R&D activities in that field (production, upgrading, and safety in mines).

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*O.J. No. C105 of 26.4.1982

To this end, it will strive to maintain and, if possible increase R&D expenditure aimed at raising the level of productivity in mines and upgrading the products of the coal industry.

The E.C.S.C. operational budget has financed, with convincing results, a Community effort to aid research into ways of achieving more economic production and better utilization and upgrading of the coal industry's products. This aid to coal research and the efforts undertaken should be continued.

In preparing the Framework Programme for the Community's scientific activities (1984-1987)* the Commission judged that R&D actions relating to the production and upgrading of coal should remain in the current E.C.S.C. programme, and that the latter should be integrated into the Framework Programme in a coherent manner.

The Energy Ministers of the Community's Member States, meeting in Copenhagen on 16 December 1982 to discuss the rôle of solid fuels in the context of a Community energy strategy aimed at diversifying energy supplies and rationalizing energy use, laid stress on the development of R&D programmes on the production and utilization of solid fuels to be carried out on a joint basis.

The coal research programme (budgetary year 1983) which forms the subject of the present memorandum and which concerns, on the one hand, mining engineering and, on the other hand, the beneficiation of the products of the coal industry, attempts to respond to the desiderata and requirements that have been formulated and requested.

The present document lists, by domain, the projects that make up the coal research programme for the budgetary year 1983, and which have formed the subject of requests for aid under the terms of Art. 55 § 2 c) of the E.C.S.C. Treaty.

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*COM(82) 865 final of 21.12.1982

The selection of these projects to form the 1983 programme was made by the Commission's services with the aid, on the one hand, of experts' committees and, on the other hand, of the Coal Research Committee (external evaluation).

In the evaluation exercise for the projects presented, priority was given to those that corresponded most closely to the criteria defined in the Medium-Term Guidelines for Technical Coal Research (1981-1985)*, whose overall objectives are:

- to improve output and productivity;
- to improve the upgrading and utilization of the products and by-products of coal mining;
- to improve the working environment, safety and environmental protection.

The fields of application covered by the 1983 programme are, for mining engineering:

- Development work in coal and stone;
- Methane studies, ventilation control and mine climate;
- Rock pressure and supports;
- Methods of working and techniques of coalgetting;
- Outbye operations underground and modern management techniques;

and, for product beneficiation:

- Mechanical coal preparation and coal transport;
- Coking of coal
- Combustion of coal and new techniques for coal utilization;
- Coal chemistry and physics and development of processes.

In making the selection, account was also taken of the Community character of the projects, which gives an extra dimension to the programme, although the topics in question form part of actions undertaken at the national, private or Community level.

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*O.J. No. C94 of 17.4.1980

In any case, the projects selected are financed only in part by the Commission (60% maximum).

The research projects forming the 1983 programme and its sub-programmes which are related to the fields mentioned above form a complement to current Community or national programmes and will be carried out in collaboration, and according to their competence and specialisation, by the following institutes and undertakings:

- The National Coal Board, London (NCB)
- The Steinkohlenbergbauverein, Essen (StBV)
- The Centre d'Etudes et Recherches des Charbonnages de France, Paris (CERCHAR)
- The Institut National des Industries Extractives, Liège (INIEX)
- The Institut d'Hygiène des Mines, Hasselt (IHM)
- The Westfälische Berggewerkschaftskasse, Bochum (WBK)
- The Acciaierie di Piombino
- The Université Libre de Bruxelles, Brussels (ULB)
- The University of Thessaloniki
- The University of Salford
- The Ente Nazionale d'Elettricità, Pisa Laboratory, (ENEL)
- Lurgi Kohle und Mineralöltechnik GmbH, Frankfurt (Lurgi)

II. RESEARCH PROGRAMME (budgetary year 1983)

The Technical Coal Research Programme (budgetary year 1983) comprises two main sections:

- A. The programme on mining engineering
- B. The Programme on product beneficiation

Each of these programmes is divided into sub-programmes in accordance with the research topics considered.

The sub-programmes are formed from the research projects selected, a list of which is annexed, and whose duration does not exceed 5 years.

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A. MINING ENGINEERING

AI. Development work in coal and stone

This sub-programme contains 7 projects with a total cost of 4 943 000 ECU.

Faster and more efficient roadway drivage is of particular importance for the opening of new mines, the extension of existing ones and for normal coalwinning operations. The main aims of the projects are, on the one hand, the mechanization, automation and integration of individual operating techniques and, on the other hand, the development of an improved support and hence improved stability of roadways and shafts. The proposed research will thus lead to both higher heading rates and improved operating results as well as to improvement of working conditions and mine safety.

1. Mechanization of shotfiring

Proposer: StBV

Budget: 1 800 500 ECU

Continuation of current work on the improvement of shotfiring with emphasis on boring techniques (percussive and rotary boring, auxiliary equipment) and mechanization of the time-consuming and demanding work of support setting (auxiliary supports, back filling techniques, sprayed concrete techniques).

2. Alignment and profile guidance of roadheaders

Proposer: NCB

Budget: 976 000 ECU

Development of a low-cost, laser-based alignment and profile guidance system for roadheaders. Increased machine availability, improved roadway stability, lighter supports and improvement of working conditions are anticipated. Two systems will be developed and tested.

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3. Automation of coal heading

Proposer: NCB

Budget: 1 038 000 ECU

Development of automatic control for the in-seam miner including a load-monitoring system, automatic horizon control (radiation measurement and microprocessor) and a steering system for the machine. The aim is to improve machine availability and to achieve higher heading rates.

4. Automatic steering of a drum shearer for correct face profile cutting

Proposer: INIEX

Budget: 130 500 ECU

Various manually-controlled machines are available for profiling the roadway cross section in heading in the face line. This project concerns automation of one such machine (programmed control with 2 or 4 degrees of freedom) to make correct profile cutting possible.

5. The investigation and development of a mechanized strata control and roadhead support system for face line ripping techniques

Proposer: NCB

Budget: 432 500 ECU

This project is aimed at full utilization of the potential of face line ripping, better roof control at the face/roadway intersection and better working conditions on the face itself by development of a universal strata control system for headings with special drum shearers and boom machines.

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6. High-pressure water jets as an additional cutting tool

Proposer: CERCHAR

Budget: 337 000 ECU

Work on increased output, improved working conditions and reduction of costs in roadway drivage as well as improved roadway stability by means of a combination of picks and high-pressure water jets on boom rippers. Comparative tests on various machines and determination of the most important parameters for machine design are planned.

7. Thermal effects during in situ concrete lining of shafts

Proposer: NCB

Budget: 228 500 ECU

Basic study of thermal effects which can lead to damage to concrete supports, the backfilling or the neighbouring rock in freezing and thawing, and thus to hazards and high costs.

III. Methane studies, ventilation control and mine climate

The sub-programme comprises 3 projects (of which 2, Nos. 9 and 10, form a joint project) with a total cost of 1 011 500 ECU.

Research in this field is of prime importance for mine safety, working conditions and unhindered conduct of operations. The projects concentrate on the improvement of special ventilation and mine climate. In addition to the benefits already mentioned, cost reductions may also be expected if, for example, expensive air cooling can be avoided through the use of other techniques for control of the climate.

8. Optimisation of combined special air conditioning installations by means of equipment for the monitoring and control of conditioning

Proposer: StBV

Budget: 371 000 ECU

Development of installations for special ventilation in roadways, that either

do not permit the desired safety limits to be exceeded or that keep on running after reaching these limits and thus permit a rapid return to normal conditions (selective disconnection). The equipment to be developed for monitoring, control and regulation will be tested on the surface and underground.

9. Study of climatic conditions in cooled and uncooled workings at great depth

Proposer: IHM

Budget: 312 500 ECU

This project is concerned with the adaptation of a German computer program for climatic prediction to different conditions to facilitate more reliable planning and maximum utilization at the lowest cost of the cooling installations that will be required in the future.

10. Study of climatic conditions underground - prediction for new mines

Proposer: CERCHAR

Budget: 328 000 ECU

The German program will also be modified and utilized in this project with the aim of avoiding or delaying the use of cooling in future new workings by the application of other measures (quantity of air, arrangement of airways, etc.).

AIII. Rock pressure and supports

There are 7 projects (including a five-part joint project) in this sub-programme, whose total cost is 2 819 500 ECU.

The research in this field is significant in two respects. In the first place, as depth increases only an adequate control of rock pressure and associated phenomena can guarantee the safety of mine workings. In the second place, face and roadway supports are a major factor in the conduct of mining operations and the economic results of mining. The proposed projects take these facts into account and will lead to positive results with respect to safety, conduct of operations and cost.

11. Control of dynamic phenomena

Proposer: CERCHAR

Budget: 505 000 ECU

Continuation of promising research on avoidance of the danger of rock bursts and similar phenomena. Emphasis is on determination of the causes of rock bursts and yield zones and development of preventive measures (special supports, special boring equipment, seismoacoustics, etc.).

12. Evaluation of observations on rocks in connection with the design of a simplified operational measuring installation for advance determination of rock properties

Proposer: StBV

Budget: 254 500 ECU

Further testing and measurement with a previously-developed multi-point measuring device for advance measurement of rock properties and yield zones is planned. It is also planned to simplify the measuring device and to deduce the causes of deformation and other rock behaviour.

13. Control of soft floor conditions at face ends and in gateroads

Proposer: NCB

Budget: 130 000 ECU

Determination of the causes of rock deformation resulting from soft floor conditions in the particularly dangerous area of the intersection between face and roadway, as well as in the gateroads. Conclusions will be drawn from the measurements about optimisation of supports, reduction of maintenance costs and improved working safety.

14. The influence of pack design on gateroad stability under differing geological conditions and mining methods

Proposer: NCB

Budget: 195 500 ECU

Instrumentation and geological testing of suitable working areas to obtain data for the development of a universal support system (pack and support). The system will make possible greater roadway stability, lower maintenance costs, improvement in safety, reduced support losses and a wider application of retreat mining.

15. Further development of support technology for roadways and faces

Proposer: StBV

Budget: 1 175 000 ECU

Development of new immediate support systems for main and in-seam roadways and faces. Emphasis is on the improvement of yielding arch supports, the development of new bolting techniques, the improvement of packing, spraying and backfilling techniques, and on the use of de-stressing chambers or slots (in the floor to avoid bulging).

16. Roadway management under difficult conditions

Proposer: CERCHAR

Budget: 329 500 ECU

This project is aimed at the optimisation of supports and the management of roadways in difficult rock conditions. It is planned to develop a suitable arch support in conjunction with the relaxation of the rock by means of large boreholes. Tests on the integrated use of anhydrite and other materials in linings and packs and the development of a combined support (steel support, bolting, linings, injection) will also be included.

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17. Increased roadway stability by bolting and combined supports

Proposer: INIEX

Budget: 230 000 ECU

Avoidance of damage to supports and expensive repairs in circular roadways with concrete supports. Study of bolting of panels in rock, increased flexibility of rings, better connection between supports and rock (bolting and injection), investigation of various types of supplementary support to improve flexibility and load-bearing capacity.

AIV. Methods of working and techniques of coalgetting

This sub-programme contains six projects with a total cost of 5 774 500 ECU.

Despite all previous achievements in the field of coalwinning itself, extensive work on the optimisation, automation and integration of the various components of the face system is still needed. In this connection, unfavourably disposed or faulted parts of coal deposits must be made accessible to mechanized winning in order to achieve better management of reserves. The proposed research addresses these questions and will thus lead to improved operating results and working conditions as well as to a more intensive exploitation of available deposits.

18. Diagnosis of operations to improve the level of utilization of ploughs

Proposer: StBV

Budget: 496 000 ECU

The project concerns the further optimisation of stripping winning and its extension to thinner seams with unfavourable characteristics. After the development of a technique for measurement and diagnosis for ploughs (instrumented picks, transducers, transmission and recording equipment) the data obtained will be evaluated and the consequences examined.

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19. Alternative methods of coal production from remnant or urban districts

Proposer: NCB

Budget: 1 464 000 ECU

Winning techniques will be developed for parts of seams which, because of their form of situation, are not suited to recovery by the conventional longwall face technique. The selection of suitable techniques (e.g. combinations of roadheading and shortwall faces) and machines, the design and testing of systems including their automation, remote control and monitoring, and finally their installation underground are envisaged.

20. Planning and conduct of operations near geological disturbances in coal

Proposer: StBV

Budget: 740 500 ECU

Continuation of current work on the early detection of geological disturbances ahead of the coal face to avoid interruption of operations. Extensive available information will be assembled to form a catalogue of practice, and recommendations for operating procedures will be developed.

21. Development of methods and equipment for traversing faults

Proposer: StBV

Budget: 1 035 000 ECU

Techniques and equipment for traversing faults in the coal face will be developed on the basis of earlier basic research. It is planned to test and further develop cutting tools and techniques, to adapt winning machines to the higher mechanical stress involved, and to develop special machines.

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22. External drive for propulsion of winning machines

Proposer: StBV

Budget: 690 000 ECU

Widening the range of application of winning machines (thinner and steeper seams) by placing the drum shearer propulsion drive unit in the gateroad. The relevant parameters will be investigated, control equipment will be developed for the traction system (chain) and suitable drive systems will be selected.

23. Further development of a vertical guidance system for shearers

Proposer: NCB

Budget: 1 349 000 ECU

The existing System 70 000 for vertical guidance of drum shearers will be developed further with the aim of widening its range of application (possibly without roof coal) and increasing machine performance. It is planned to use a microprocessor system, to adapt the machine's control equipment, to test suitable transmitters and to integrate the equipment with the MIDAS monitoring system.

AV. Outbye operations underground

The sub-programme comprises six projects with a total cost of 2 429 000 ECU.

With increasing distances, increasing quantities of material and increasing equipment weight, all aspects of transport- and supply technology are acquiring special importance for the further rationalisation of underground operations. Moreover, the installation of higher output mining machinery makes necessary the replacement and improvement of power- and supply technology. The projects proposed will contribute towards the solution of these problems and will also have a beneficial effect on mine safety and working conditions.

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24. Uninterrupted trackless transport in roadways and shafts

Proposer: StBV

Budget: 905 500 ECU

An uninterrupted system for trackless transport from the surface to the work area will be developed as a prerequisite for the introduction of specialized vehicles and a simplification of material transport. This involves the development of load units adapted to vehicles and shafts, mechanization of shaft delivery, construction and testing of a vehicle for use in main roadways, mechanization of transfer, and the planning of supply and delivery.

25. Study of the improvement of measurement costs and reliability in the monitoring of shaft control equipment, and of the avoidance of breakdown and damage to transport equipment

Proposer: WBK

Budget: 603 500 ECU

An available inertial measuring device (similar to an inertial navigational system) will be further developed for measurement in shafts with simultaneous measurements on shaft control equipment. In addition to improved certainty of measurement and greater safety in shaft winding operations, a drastic reduction should be achieved in the time required to carry out these routine measurements.

26. Testing of seals

Proposer: NCB

Budget: 100 500 ECU

Extensive testing of mechanical seals on mining machinery with the aim of increasing their working life and reliability. Determination of the operating life of existing seals, determination of the influence of various parameters, testing of dirt-shedding shields and labyrinths, and design of new seals.

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27. Testing of specimen gears to provide test data

Proposer: NCB

Budget: 158 000 ECU

Systematic test rig studies of the behaviour and operational life of gears for mining machinery. On the basis of the results, recommendations will be drawn up for the choice of materials, reduction of noise levels, dimensions and costs, and increase in reliability.

28. Improvement of electrical supply technology by faster reactive current compensation

Proposer: StBV

Budget: 229 000 ECU

Development, construction and testing of a flameproof, thyristor-controlled reactive current compensation unit to reduce the load on the supply network and to improve the start-up characteristics of asynchronous motors, particularly by reducing voltage drop and power losses.

29. Earth fault discrimination

Proposer: NCB

Budget: 432 500 ECU

After an investigation of available processes for detecting earth faults and the determination of requirements a new earth fault discrimination system will be developed and tested. The system will make it possible to avoid the switching-off of healthy equipment as a consequence of a fault in another part of the system.

AVI. Modern management techniques

The sub-programme contains six projects (including a four-part joint project, Nos. 30 to 33) and has a total cost of 4 115 500 ECU.

As the complexity of mining operations has increased, it has become essential to apply the most up-to-date regulation, control, monitoring and information technology. In addition to further improvement of methods for data collection, transmission and evaluation, the development of microprocessor technology opens up new possibilities that will be utilized in the proposed projects. The latter will have a favourable influence on working conditions and mine safety, as well as contributing to well-conducted operations and reductions in cost.

30. Management information systems (secondary computers)

Proposer: NCB

Budget: 1 289 500 ECU

Available information systems will be made more flexible and more universal through the application of the most up-to-date technology. To this end, the required interface and peripheral equipment, the necessary software and new devices and techniques for data collection and information processing will be developed.

31. Development of underground switchgear

Proposer: NCB

Budget: 705 000 ECU

Development, construction and testing of remotely-controlled protection devices and control and monitoring equipment (sensors and transmitters, data transmission to existing networks, improved earth leakage lockout system) that can be used for rapid reconnection of safety- and production equipment after the correction of faults.

32. Components for an integrated control and monitoring system

Proposer: StBV

Budget: 388 500 ECU

Continuation of current work on the development of a comprehensive, integrated control- and monitoring system with a hierarchical structure for mining operations, further development of existing data transmission units with respect to feeder systems and local and long-distance cables, and underground testing are planned.

33. Computer-aided sub-stations

Proposer: StBV

Budget: 259 000 ECU

The project is concerned with the development of a sub-station for the "integrated control and monitoring system". This unit which is subordinated to the process management level, will make possible the computer processing of all the relevant data, the display of information on a TV screen, control by dialogue with the display, and the management of operations.

34. Data-gathering techniques

Proposer: NCB

Budget: 692 500 ECU

A simple, universal system for data gathering and processing in connection with investigations on mine machinery will be developed with the aim of maintaining the efficiency of underground equipment. After the determination of specifications, a prototype system will be tested and modified, equipment for data processing will be acquired and the necessary software will be developed.

35. Spine belt control system

Proposer: NCB

Budget: 781 000 ECU

A computer-based control system based on the MINOS system will be developed for a highly complex spine conveying system (two central belts with 11 bunkers). In particular, rules for bunker discharge will be determined, and the software for belt control, mineral segregation control and system to prevent belt overloading and spillage will be developed.

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B. PRODUCT BENEFICIATION

BI. Mechanical coal preparation and coal transport

The sub-programme comprises 5 projects whose total cost is 1 259 000 ECU.

The principal aim of Community research in coal preparation is to enable the mining industry to maintain and improve the quality of its products in the face of changes in the quality of run-of-mine coal (increasing proportions of water, dirt and fine material) resulting from the application of modern mining technology.

The sub-programme will contribute towards a reduction in the cost of cleaning fines, and also to improvements in the efficiency of coal preparation in general. It will thus help the coal industry to supply improved products at lower prices.

36. Crushing and de-ashing of coal

Proposer: INIEX

Budget: 129 000 ECU

Investigation of the fine crushing and cleaning of coal for use in coal/liquid mixtures to replace oil in boiler firing, and research into the combustion of coal/oil and coal/water mixtures using adapted oil burners. The combustion of pulverized coal and solid residues from coal hydrolysis will also be studied.

37. New techniques for upgrading fine slurries

Proposer: CERCHAR

Budget: 269 000 ECU

Investigation aimed at defining a sequence of treatments that will make it possible for fine coal (less than 0.5 mm) to be used directly as an industrial fuel, thus avoiding the need for drying. The research covers three aspects of the problem: the cleaning and dewatering of fines, coal crushing, and a preliminary economic evaluation of the overall treatment.

38. De-ashing of particulate coals by dry magnetic separation techniques

Proposer: University of Salford

Budget: 84 500 ECU

Evaluation of the relative effectiveness of two magnetic separation techniques for the removal of ash and reduction of the pyritic sulphur content of a range of coals.

39. Study of the classification and dewatering of European coals by the Otisca process

Proposer: StBV

Budget: 431 500 ECU

Application to European coals of a separation technique, developed in the USA, employing a heavy organic medium (trichlorofluoromethane) which gives a sharp separation of fines and improved dewatering.

40. Nucleonic methods for the measurement of coal and ash

Proposer: NCB

Budget: 345 000 ECU

The aim of the project is to improve the efficiency of coal preparation through better monitoring of the mineral content of coal. The research involves the testing of a number of on-line monitoring devices whose performance will be studied in the laboratory, on a test installation and under operational conditions.

BII. Coking of coal

The total cost of this sub-programme, which contains 9 projects amounts to 4 149 000 ECU.

The projects are related to the main objectives of Community research on carbonization, i.e. improving the performance of coke ovens, widening the range of coals that can be carbonized, maintaining or improving coke quality, and solving pollution problems associated with coking plant. The importance of research in this field lies principally in the fact that the cost and quality of blast furnace coke are significant factors in determining the cost of production of pig iron, and hence the competitiveness of the steel industry.

41. Influence of alkalis on the thermo-mechanical size stability of bulk coke

Proposer: NCB

Budget: 917 000 ECU

Study of the effect of alkalis on the quality of coke of the size charged to blast furnaces aimed at specifying coal blends and carbonizing conditions for the production of coke that is stable and resistant to alkali attack.

42. Coal oxidation

Proposer: CERCHAR

Budget: 156 500 ECU

Development of a test to detect low levels of oxidation in coking coals in order to avoid undesirable repercussions during carbonization. In addition, the mechanism of coal oxidation will be investigated, the use of additives to counteract the effects of oxidation will be studied on the laboratory scale, and pilot-scale investigations of the effects of oxidation on coke quality will be carried out.

43. Mechanical properties of coke under simulated blast furnace conditions

Proposer: StBV

Budget: 278 500 ECU

Further development of a method of characterizing coke in relationship to its behaviour in the blast furnace. Correlation of structural parameters of coke with mechanical properties. Consideration of the effect of carbonization and coking conditions. Tests will be carried out on coke of the size used in the blast furnace rather than on the small material normally used in laboratory tests.

44. Study of preheated and compacted blends for charging into industrial coke ovens at industrial rates

Proposer: CERCHAR

Budget: 244 500 ECU

Study aimed at developing blends to achieve consistent metallurgical coke production under industrial conditions over long periods of time and at reducing the consumption of high-quality coking coal by the combined use of preheating and compaction of the coal charge. The project is a continuation of joint Franco-German research on this topic.

45. Partially-pelletized composite coal mixtures for coke ovens

Proposer: Acciaierie di Piombino

Budget: 492 500 ECU

Confirmation on the industrial scale of laboratory- and pilot-scale results on the application of partial pelletization of the coal charge as a means of improving coke quality and increasing coke oven productivity.

46. Material balances in carbonization

Proposer: CERCHAR

Budget: 406 000 ECU

Detailed mass balances on modern coke ovens under normal operating conditions and using the most up-to-date charge preparation techniques. The influence of oven height, charging frequency, environmental protection systems, etc., will be studied. The results will lead to the elimination of product losses and the improvement of pollution control.

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47. Measurement of temperature in coke oven heating flues

Proposer: StBV

Budget: 172 500 ECU

Further development and practical application of a temperature probe, developed in an earlier project, for measuring the vertical temperature profile in coke oven heating flues to aid the optimization of heating in carbonization. Equipment for measuring the emissivity of refractorise at high temperature will also be developed and tested.

48. Process coupling between a recuperatively-heated coke oven and coal preheating

Proposer: StBV

Budget: 1 091 000 ECU

Utilization of heat from coke oven flue gases to preheat the coal charge in order to improve the thermal efficiency of coke oven operation (This development is linked to an existing project using coke ovens with recuperative heating in place of the normal regenerators).

49. The thermal technology of coke ovens II

Proposer: StBV

Budget: 390 500 ECU

Further development of research aimed at reducing the energy consumption of coke ovens by optimizing oven heating. A mathematical model of the behaviour of the oven charge will be developed and tested. This model will be coupled to another, developed in an earlier project, which describes the heating of the oven.

BIII. Combustion of coal and new techniques for coal utilization

The sub-programme contains 7 projects and has a total cost of 2 478 500 ECU.

The aims of the research work in this field are: first, to encourage the wider use of coal in industry as a substitute for other fuels by improving the economy, convenience and environmental acceptability of coal as a boiler fuel in this potentially large market; secondly, to alleviate the problem of disposal of waste material from coal mining which, in addition to its environmental repercussions, imposes a financial burden on the Community's mining industry.

50. Fluidised bed combustion of low-grade fuels

Proposer: INIEX

Budget: 184 000 ECU

Research into the utilization of the residual energy in low-grade materials, such as washery tailings and spoil tips, with the particular aim of recovering aluminium or other metals by means of gas/solid reactions, rather than by more conventional treatment with acids.

51. Developing a measure of coal handlability applicable to industrial equipment

Proposer: NCB

Budget: 709 500 ECU

Development of tests to give an index of coal handlability as an aid to the design of improved equipment for coal storage, recovery and handling in industry. The investigation will include assessment of existing laboratory tests and development of new ones where necessary and the development of a range^{of} reference equipment for standard tests.

52. Utilization of washery tailings in civil engineering

Proposer: StBV

Budget: 351 500 ECU

Continuation of the development and testing of equipment and processes for the manufacture of materials for use in building and civil engineering from washery tailings (e.g., materials for road construction or back-filling, etc. underground, concretes, porous building blocks, mortar, etc). Optimisation of materials developed in earlier projects.

53. Trace element emission from fluidised bed combustion units

Proposer: NCB

Budget: 301 000 ECU

Study of the fate of selected trace elements in coal on combustion in both atmospheric pressure fluidised bed combustors and stoker firing, with particular emphasis on stack emissions, to assess possible risks to the environment.

54. Minimisation of emissions in pressurised fluidised bed combustion

Proposer: StBV

Budget: 310 500 ECU

The aim of the project is to obtain data that will enable full-scale pressurised fluidised bed combustors to be designed with optimum environmental acceptability. Factors influencing the emission of oxides of sulphur and nitrogen, products of incomplete combustion and volatile halogen compounds will be investigated over a range of pressures, temperatures, coals and sulphur-absorbing additives.

55. Study of pollution from fluid bed boilers

Proposer: CERCHAR

Budget: 183 500 ECU

Study aimed at improving knowledge of pollution problems associated with fluidised bed combustion of coal at atmospheric pressure, and thus at improving the ability of equipment manufacturers to overcome these problems. The work will include bibliographic and theoretical studies, development of methods of sampling and analysis for various pollutants, and measurements on a range of laboratory and demonstration-scale combustors.

56. Study of organic trace pollutants discharged from coal-fired power stations

Proposer: ENEL

Budget: 438 500 ECU

Identification and measurement of carcinogenic trace pollutants (especially polynuclear aromatic hydrocarbons) resulting from incomplete combustion in coal-fired power stations. The mechanism of formation of such compounds will also be studied with a view to preventing their formation by optimizing combustion conditions.

BIV. Coal chemistry and physics and development of processes

The total cost of the 8 projects in this sub-programme is 6 994 000 ECU.

The emphasis of the sub-programme is on the conversion of coal to gaseous or liquid products that can replace oil-derived fuels and chemicals. However, it covers a very wide range of basic studies relating to a variety of coal upgrading processes, and includes some work on solid products and by-products. As in other sub-programmes, while some of the topics covered are new, others involve continuation of work that has received support in the past and has yielded encouraging results.

57. Fluidised bed gasification for low- and medium calorific value gases

Proposer: NCB

Budget: 1 769 000 ECU

Further development of promising research on a two-stage process for fluidised bed gasification and combustion of coal. The present project is aimed at examining aspects of the process for which more information is needed for design purposes, and at studying further industrial applications of the process.

58. Investigation of the reaction behaviour of coal in moving bed gasification reactors

Proposer: Lurgi

Budget: 274 500 ECU

Development of a method to facilitate reliable prediction of the reaction behaviour of different types of coal in commercial-size reactors. The project includes bench-scale gasification studies to obtain information about coal and char behaviour and product yields, development of a mathematical model and correlation of experimental results with data from commercial- or pilot-scale gasifiers.

59. Study of coal conversion processes

Proposer: CERCHAR

Budget: 509 500 ECU

This project is concerned with the conversion of coal to liquid or gaseous products, and with some of the solid and liquid by-products of the conversion processes in question. Rapid hydrolysis of coal by injection into a molten metal or salt bath will be investigated on a scale of up to several kg/hr. The project will also include studies of pitch-like materials and their use as binders in carbonization, and of the characteristics of solid residues from coal liquefaction and pyrolysis.

60. Physical and chemical upgrading of coal and coal by-products

Proposer: CERCHAR

Budget: 165 000 ECU

Laboratory studies aimed at improving the conversion of coal into desirable liquid and gaseous products. This project includes some fundamental work on rapid hydrolysis. It is also concerned with the investigation of coal liquefaction under hydrogen pressure with a view to simplifying and improving the process, and with the upgrading of coal by-products. Both the development of new processes and the adaptation of existing techniques from the oil industry will be considered.

61. Physical and chemical valorisation of coal

Proposer: StBV

Budget: 2 328 500 ECU

Further development of a wide range of basic studies related principally to coal liquefaction, carbonization and the upgrading of carbonization by-products.

- Basic studies of coal liquefaction by existing and new techniques
- Research on the character and upgrading of liquid and solid products and by-products from coal
- Petrographic studies and investigation of maceral behaviour
- Studies related to carbonization of coal and coal/binder mixtures
- Miscellaneous topics: organic sulphur compounds in coal; reactions of coal/water suspensions under extreme conditions; properties of fluidised bed combustion residues.

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62. Devolatilisation of coal under hydrogen pressure

Proposer: ULB

Budget: 681 000 ECU

Study of the devolatilisation of coal under hydrogen pressure aimed at determining the parameters affecting the degree of gasification the yield of liquid and gaseous products, the degree of desulphurisation and the reactivity of the residual char. The mechanism of degradation of the primary devolatilisation products will also be investigated.

63. Direct conversion of coal to chemical feedstocks

Proposer: NCB

Budget: 816 500 ECU

The aim of the project is to find more effective means of obtaining chemical feedstocks (light hydrocarbons and heavy tars) from coal by pyrolysis and subsequent treatment of the vapours obtained. Investigations at both low and high pressures will be concerned with increasing product yields, decreasing the severity of reaction conditions and widening the range of coals that can be processed.

64. Catalytic gasification of lignite for synthetic fuels

Proposer: University of Thessaloniki

Budget: 450 000 ECU

Laboratory studies of catalytic gasification and methanation aimed at improved utilization of indigenous resources in an environmentally acceptable manner by conversion into synthetic fuels. The research will include characterisation of raw materials, selection, preparation and testing of catalysts, and improved modelling of gasification and methanation to aid process evaluation and selection.

III. ABSTRACTING AND TRANSLATION OF THE TECHNICAL LITERATURE ON COAL OF EASTERN EUROPE, SCANDINAVIA, THE MIDDLE EAST AND THE FAR EAST

On four occasions since 1962, the Commission has granted a credit of 100 000 ECU for this action which involves:

- the systematic abstracting of the technical literature, limited to certain subjects of current interest, and the preparation of analytical summaries. The technical literature on coal in the so-called "difficult" languages is thus monitored.
- the summaries are distributed to research workers by the documentation centres in the Community's coal-producing countries. Translations are then requested by the researchers as the need arises.

The texts analysed and the translations are regularly exchanged among the Community's coal research institutions.

This action makes it possible for the development of coal technology in countries with "difficult" languages to be followed. Moreover, it has been possible, through this mechanism, to apply, within the Community, technology used elsewhere. Examples are provided by shield supports, ventilation control, prevention of rockbursts, etc.

Aid amounting to 150 000 ECU is judged necessary and appropriate for the continuation of the action.

IV. RESEARCH RESULTS

The E.C.S.C. Experts' Committees which are competent to cover the realisation of the work in the various fields of the programme will supervise and keep under review the execution of the research work that forms the subject of the proposals.

The agreements to be concluded with the beneficiaries of the aid will define the rights and obligations of the contracting parties. They will be designed primarily to ensure that the research results will be made available to all concerned in the Community, in accordance with Art. 55 of the E.C.S.C. Treaty.

V. CONCLUSIONS

In view of the importance and interest of the planned research programme, the granting of financial aid by the E.C.S.C. for the implementation of the projects that it comprises is judged to be appropriate and justified.

The total cost of the projects amounts to 35 973 500 ECU and the Commission proposes to grant aid totalling 21 584 100 ECU to cover a part of the research costs. A sum of 64 800 ECU is reserved for the dissemination of results and associated costs. In addition, 150 000 ECU are earmarked for the abstracting and translation of the technical literature on coal of Eastern Europe, Scandinavia, the Middle East and the Far East.

APPENDIX - TABLE OF RESEARCH PROJECTS

31.

Project No.	Project title	Proposed research		Financial aid	
		by	Budget ECU (30.11.82)	%	Amount ECU (30.11.82)
	<u>A. MINING ENGINEERING</u>				
	<u>AI. Development work in coal and stone</u>				
1	Mechanization of shotfiring	StBV	1 800 500	60	1 080 300
2	Alignment and profile guidance of roadheaders	NCB	976 000	60	585 600
3	Automation of coal heading	NCB	1 038 000	60	622 800
4	Automatic steering of a drum shearer for correct face profile cutting	INIEX	130 500	60	78 300
5	The investigation and development of a mechanized strata control and roadhead support system for face line ripping techniques	NCB	432 500	60	259 500
6	High-pressure water jets as an additional cutting tool	CERCHAR	337 000	60	202 200
7	Thermal effects during in situ concrete lining of shafts	NCB	228 500	60	137 100
	SUB-TOTAL AI		4 943 000		2 965 800
	<u>AII. Methane studies, ventilation control and mine climate</u>				
8	Optimisation of combined special air conditioning installations by means of equipment for the monitoring and control of conditioning	StBV	371 000	60	222 600
9	Study of climatic conditions in cooled and uncooled workings at great depth	IHM	312 500	60	187 500
10	Study of climatic conditions underground - prediction for new mines	CERCHAR	328 000	60	196 800
	SUB-TOTAL AII		1 011 500		606 900

Project No.	Project title	Proposed research		Financial aid	
		by	Budget ECU (30.11.82)	%	Amount ECU (30.11.82)
	<u>AIII Rock pressure and supports</u>				
11	Control of dynamic phenomena	CERCHAR	505 000	60	303 000
12	Evaluation of observations on rocks in connection with the design of a simplified operational measuring installation for advance determination of rock properties	StBV	254 500	60	152 700
13	Control of soft floor conditions at face ends and in gateroads	NCB	130 000	60	78 000
14	The influence of pack design on gateroad stability under differing geological conditions and mining methods	NCB	195 500	60	117 300
15	Further development of support technology for roadways and faces	StBV	1 175 000	60	705 000
16	Roadway management under difficult conditions	CERCHAR	329 500	60	197 700
17	Increased roadway stability by bolting and combined supports	INIEX	230 000	60	138 000
	SUB-TOTAL AIII		2 819 500		1 691 700
	<u>AIV Methods of working and techniques of coalgetting</u>				
18	Diagnosis of operations to improve the level of utilization of ploughs	StBV	496 000	60	297 600
19	Alternative methods of coal production from remnant or urban districts	NCB	1 464 000	60	878 400
20	Planning and conduct of operations near geological disturbances in coal	StBV	740 500	60	444 300
21	Development of methods and equipment for traversing faults	StBV	1 035 000	60	621 000
22	External drive for propulsion of winning machines	StBV	690 000	60	414 000
23	Further development of a vertical guidance system for shearers	NCB	1 349 000	60	809 400
	SUB-TOTAL AIV		5 774 500		3 464 700

Project No.	Project title	Proposed research		Financial aid	
		by	Budget ECU (30.11.82):	%	Amount ECU (30.11.82)
	<u>AV Outbye operations underground</u>				
24	Uninterrupted trackless transport of materials in roadways and shafts	StBV	905 500	60	543 300
25	Study of the improvement of measurement costs and reliability in the monitoring of shaft control equipment, and of the avoidance of breakdown and damage to transport equipment	WBK	603 500	60	362 100
26	Testing of seals	NCB	100 500	60	60 300
27	Testing of specimen gears to provide test data	NCB	158 000	60	94 800
28	Improvement of electrical supply technology by faster reactive current compensation	StBV	229 000	60	137 400
29	Earth fault discrimination	NCB	432 500	60	259 500
	SUB-TOTAL AV		2 429 000		1 457 400
	<u>AVI Modern Management techniques</u>				
30	Management information systems (secondary computers)	NCB	1 289 500	60	773 700
31	Development of underground switchgear	NCB	705 000	60	423 000
32	Components for an integrated control- and monitoring system	StBV	388 500	60	233 100
33	Computer-aided sub-stations	StBV	259 000	60	155 400
34	Data-gathering techniques	NCB	692 500	60	415 500
35	Spine belt control system (Selby)	NCB	781 000	60	468 600
	SUB-TOTAL AVI		4 115 500		2 469 300
	TOTAL A		21 093 000		12 655 800

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Project No.	Project title	Proposed research		Financial aid	
		by	Budget ECU (30.11.82)	%	Amount ECU (30.11.82)
	B. <u>PRODUCT BENEFICIATION</u>				
	BI <u>Mechanical coal preparation and coal transport</u>				
36	Crushing and de-ashing of coal	INIEX	129 000	60	77 400
37	New techniques for upgrading fine slurries	CERCHAR	269 000	60	161 400
38	De-ashing of particulate coals by dry magnetic separation techniques	Univ. of Salford	84 500	60	50 700
39	Study of the classification and dewatering of European coals by the Otisca process	StBV	431 500	60	258 900
40	Nucleonic methods for the measurement of coal and ash	NCB	345 000	60	207 000
	SUB-TOTAL BI		1 259 000		755 400
	BII <u>Coking of coal</u>				
41	Influence of alkalis on the thermo-chemical size stability of bulk coke	NCB	917 000	60	550 200
42	Coal oxidation	CERCHAR	156 500	60	93 900
43	Mechanical properties of coke under simulated blast furnace conditions	StBV	278 500	60	167 100
44	Study of preheated and compacted blends for charging into industrial coke ovens at industrial rates	CERCHAR	244 500	60	146 700
45	Partially pelletized composite coal mixtures for coke ovens	Acciaiere di Piombino	492 500	60	295 500
46	Material balances in carbonization	CERCHAR	406 000	60	243 600
47	Measurement of temperature in coke oven heating flues	StBV	172 500	60	103 500

Project No.	Project title	Proposed research		Financial aid	
		by	Budget ECU (30.11.82)	%	Amount ECU (30.11.82)
48	Process coupling between a recuperatively-heated coke oven and coal preheating	StBV	1 091 000	60	654 600
49	The thermal technology of coke ovens II	StBV	390 500	60	234 300
	SUB-TOTAL BII		4 149 000		2 489 400
	<u>BIII Combustion of coal and new techniques for coal utilization</u>				
50	Fluidised bed combustion of low-grade fuels	INIEX	184 000	60	110 400
51	Developing a measure of coal handlability applicable to industrial equipment	NCB	709 500	60	425 700
52	Utilization of washery tailings in civil engineering	StBV	351 500	60	210 900
53	Trace element emission from fluidised bed combustion units	NCB	301 000	60	180 600
54	Minimisation of emissions in pressurised fluidised bed combustion	StBV	310 500	60	186 300
55	Study of pollution from fluid bed boilers	CERCHAR	183 500	60	110 100
56	Study of organic trace pollutants discharged from coal-fired power stations	ENEL	438 500	60	263 100
	SUB-TOTAL BIII		2 478 500		1 487 100
	<u>BIV Coal chemistry and physics and development of processes</u>				
57	Fluidised bed gasification for low- and medium calorific value gases	NCB	1 769 000	60	1 061 400
58	Investigation of the reaction behaviour of coal in moving bed gasification reactors	Lurgi	274 500	60	164 700
59	Study of coal conversion processes	CERCHAR	509 500	60	305 700
60	Physical and chemical upgrading of coal and coal by-products	CERCHAR	165 000	60	99 000

Project No.	Project title	Proposed research		Financial aid	
		by	Budget ECU (30.11.82)	%	Amount ECU (30.11.82)
61	Physical and chemical valorisation of coal	StBV	2 328 500	60	1 397 100
62	Devolatilisation of coal under hydrogen pressure	ULB	681 000	60	408 600
63	Direct conversion of coal to chemical feedstocks	NCB	816 500	60	489 900
64	Catalytic gasification of lignite for synthetic fuels	Univ. of Thessa-loniki	450 000	60	270 000
	SUB-TOTAL BIV		6 994 000		4 196 400
	TOTAL B		14 880 500		8 928 300
	TOTAL A + B		35 973 500		21 584 100
	Abstracting and translation of the technical literature on coal of Eastern Europe, Scandinavia, the Middle East and the Far East		150 000	100	150 000
	Dissemination of results and associated charges		64 800	100	64 800
	GRAND TOTAL		36 188 300		21 798 900