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## MEMORANDUM

CONCERNING A COMMUNITY COAL RESEARCH PROGRAMME IN THE FIELD OF MINING TECHNOLOGY WITH A VIEW TO OBTAINING FINANCIAL AID UNDER THE TERMS OF ARTICLE 55 § 2 c) OF THE E.C.S.C. TREATY.

(Budgetary year 1977)

## MEMORANDUM

CONCERNING A COMMUNITY COAL RESEARCH PROGRAMME IN THE FIELD OF PRODUCT BENEFICIATION WITH A VIEW TO OBTAINING FINANCIAL AID UNDER THE TERMS OF ARTICLE 55 § 2 c) OF THE E.C.S.C. TREATY

(Budgetary year 1977)



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TWO MEMORANDA

The Commission of the European Communities has, on several occasions, expressed itself very clearly on the question of coal research, both in its energy policy immediately after the events of 1973, and again more recently.

It considers that this research is an important factor in maintaining and improving the economy. With regard to coal, the aims of research are identical to those of the coal industry, that is to say :

- to maintain annual production at the current level of 250 million tcc if possible
- to improve productivity and stability of production costs
- to achieve improved utilization and valorisation of the products of the coal industry
- to improve working conditions.

For coal, an increased research effort during the coming decade constitutes one of the means of achieving the objectives for production and productivity.

The priority areas defined in the Medium-Term Research Programme 1975-1980, published in the OJ n° C 60 of May 1974 and supplemented by the publication in the OJ n° C 160 of December 1974, where the criteria for the selection of research projects were re-specified, are still valid.

The Medium-Term Guidelines for Coal, 1975-1985, published in the OJ in January 1975 also describe the Commission's research policy concisely.

To put this R & D activity into practice, the Commission has already decided to grant aid in 1975 and 1976 to a total of 32.2 MUC for the carrying-out of coal research programmes for which contracts have been signed by the Commission.

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For 1977, the Commission has received more than fifty requests for financial aid within the framework of its Medium-Term Programme, 1975-1980 and under the terms of Article 55 § 2 c) of the E.C.S.C. Treaty.

These research proposals have been examined and studied by the Services of the Commission in collaboration with the experts of the Commission's Coal Research Committee (CRC) in order to make a selection which will enable the E.C.S.C.'s financial efforts to be concentrated on projects which enter into the Medium-Term Programme and which correspond most closely to the criteria specified therein.

Following examination by the Coal Research Committee on 8 November 1976, the proposed selection, which includes 38 projects representing an overall cost of the order of 3 MEUA, received a favourable opinion. The total aid necessary to carry out these projects amounts to about 18 MEUA.

Two memoranda have been prepared corresponding to the projects selected, one concerning the programme on mining technology for which aid amounting to 12 MEUA is foreseen, and the other relating to coal valorisation, for which aid of 6 MEUA is foreseen. It is envisaged that 100,000 EUA will be required to cover the costs of dissemination of information and related costs.

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N.B. The parity for the EUA is that of 8 November 1976.

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(Budgetary year 1977)

I. General remarks

In deciding on the coal research programme for the coming year it is essential to consider the energy situation in general and the position of the Community's coal mines in particular. Only in this way is it possible to justify sufficiently the employment of public funds for research and development in the field of mining technology.

It is clear that the consequences of the 1973/74 energy crisis have been largely forgotten because the crisis has not made itself felt directly in terms of a lasting energy shortage for the individual consumer, but only indirectly through the effect of massive increases in energy price levels on the national economies of the Community. These have been an important factor in the worldwide economic recession of the last two years and have also consequently contributed to the fact that the expectations expressed in 1974, particularly for the Community's coal mining industry, have not been fulfilled, but have been virtually reversed.

It must be asked whether these effects are of a temporary, short-term nature, or of a long-term nature, and therefore that coal can play in the future in its two main markets - steel production and electricity generation - must be examined.

In the long term, and ignoring the current situation, a further increase in steel consumption is expected. Furthermore, since the blast furnace

must play a dominant rôle in iron production, at least in the foreseeable future, and since its specific coke need cannot be reduced below a certain minimum level, the future for coking coal seems to be assured. This is further confirmed by the increasing efforts of some of the Community's coal producing countries either to acquire coking coal mines in third countries or to widen the coking coal basis by the development of new processes, such as the manufacture of formed coke.

In the field of electricity generation the future of coal will depend largely on the development of nuclear energy, in spite of the recent greatly increased use of natural gas. With regard to nuclear energy, a certain disenchantment has arisen on technical, safety and economic grounds, and this opens up good future prospects for coal. However, coal can only be used if it succeeds in meeting the increasingly severe requirements for environmental protection, either through the preparation of suitable products or through the improvement of conventional processes or the development of new techniques for the generation of electricity.

In conclusion, it seems that the long-term outlook for coal as an energy source and as a raw material is highly promising. The Commission of the European Communities has taken account of this both by its approval of the "Medium-term Guidelines for Coal 1975-1985" (OJ No. C22 of 30/1/1975) and by its more recent proposals and actions. Mention need be made here only of the financing of coal stocks, the easing of the financing of the construction of new coal-fired power stations and, of special significance here, the greatly increased aid for coal research. The reason for the latter development was the expectation that a strengthened R & D effort would help the Community's coal mines to achieve the objectives necessary to secure their future, namely:

- to make available competitive products which could, moreover serve as a stabilising influence in the event of further increases in energy price levels
- thereby to achieve optimum use of available reserves, and
- to offer more attractive working conditions to the labour force.

As evidence for the justification of these hopes it may be said that the development of the Community's coal mines in the last twenty years is due mainly to the consequences of improved mining technology which, in turn, is the result of an undiminished R & D effort.

On the above-mentioned grounds, the Commission proposes the approval of a Community research programme in the field of mining technology which will be undertaken by the following institutions:

- 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 N.V. Kempense Steenkolenmijnen, Houthalen (KSM)

in close collaboration and for which financial aid is requested under the terms of Article 55 § 2 c) of the E.C.S.C. Treaty.

## II. Aims and objectives of the programme

The objectives which must be achieved in the field of mining technology in order to secure the future for coal can be summarised in a few key points.

### Working conditions and protection of the environment

Under this heading the prime objective is to offer safe and attractive working conditions to the labour force that will be required. For this, it is necessary:

- continuously to improve mine safety, especially with regard to the control of methane and rock pressure in changing and apparently worsening conditions, and
- to make the working environment more tolerable by, among other things, measures to improve the mine climate, new equipment for quick, safe and comfortable transport of personnel, improved communications, etc.

A further important aspect is the preparation of products which can be used without damage to the surface environment. The most important measure in this field must be the reduction of the sulphur content of coking - and power station coal and - in the longer term - reduction in the ash content of the latter.

### Technology

In the field of coal winning there is important work to be done to achieve better utilization of available seams, to avoid, or at least to diminish the difficulties and initial cost of opening new seams or advancing to increased depths. The most important measures here are:

- to extend to less favourably-situated seams the results already achieved in high-output faces
- the search for winning techniques which can be used in sloping seams which, with existing techniques, cannot be included in winnable reserves on technical and economic grounds.

In the field of infrastructure means of transport and conveying are needed which can match up to constantly increasing output per operational unit, or can accommodate the ever-increasing distances and size and quantity of equipment, and can be used simultaneously for personnel transport.

### Mining economy and market requirements

From the economic viewpoint, all research proposals contribute towards the improvement of the results of mine operation, and thus towards the maintenance of the competitiveness of the Community's coal mines. To fulfil market requirements, it is especially necessary to adapt coal preparation, which is at the interface between mine operation and the market, to increased throughputs (preparation of coking- and power station coal) where the raw coal will contain increasing quantities of water, ash and fine material.

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The new research programme proposed takes account of the above requirements and falls into four main areas which are covered by the following sub-programmes

- Methane studies, climatic problems, rock pressure and supports
- Methods of working and techniques of coalgetting
- Outbye services underground
- Mechanical coal preparation

### III. Programme of work envisaged

The new research programme consists of four sub-programmes containing a total of 20 proposals which are itemised below. The whole programme will be carried out in close collaboration between the research institutions and the Community's coal mines.

#### Programme "Methane studies, climatic problems, rock pressure and supports"

This programme consists of six proposals, and concerns the natural phenomena which are encountered in underground work. The work envisaged is based partly on the results of earlier research and should contribute towards the solution of technical and safety problems which have arisen from the most recent developments.

##### 1. Development of methods for controlling methane (CERCHAR)

This proposal is aimed at improved prediction of emission, particularly in the neighbourhood of faces and roadway drivages, and at the perfection of processes for controlling emission in normal operation.

Total cost : 2, 103, 600 FF

2. Control of mine climate in the presence of high rock temperatures and high-output operation (StBV)

Experiments are planned on the influence of technical developments in mining on heat pickup by the mine atmosphere, and on efficient means of controlling the mine climate, as well as on the further development of cooling installations and cooled garments.

Total cost: 2, 200,000 DM

3. The use of chilled dust suppression water and other techniques to control heat emission on the coal face (NCB)

Further experiments will be carried out on the heat balance in coal-winning, using the water necessary for dust suppression to cool the mine atmosphere and including the development of compact cooling installations for the particularly badly-affected areas at face ends.

Total cost: 187,240 £

4. Improved stability of walls and roofs (CERCHAR)

The main feature of the experiments is the avoidance of the collapse of high walls in steep seams by experiments on the mechanism of crack formation, deformation and disintegration, and by the development of processes for monitoring and controlling these phenomena.

Total cost: 5,493,600 FF

5. Face and roadway stability: Geological criteria (NCB/University of Newcastle)

This proposal is aimed at an improved design of access roadways to longwall faces through an increased knowledge of the deformation and yield of strata around faces and of the relation of deformation and yield to the mechanical properties of the rock.

Total cost: 55,040 £

6. Prediction of strata stability from instrumentation and modelling data (NCB/University of Cardiff)

Work is planned on the determination and evaluation of interactions between the factors that influence strata movement and deformation, especially in faces and roadways, the improvement of measurement equipment for this purpose, and the use of models to simulate underground situations.

Total cost: 82,500 £

Programme "Methods of working and techniques of coalgetting"

This programme consists of six projects whose aim is the economic working of inclined seams, the further optimisation and automation of face operations, and improved solutions to the difficult problems of face/roadway intersections.

7. New coalwinning and transport systems for inclined seams (StBV)

The emphasis here is on the development of a new winning technique in the form of a combination of supportless winning and hydraulic transport. This should make possible the economic winning of extensive reserves in inclined seams which have largely been already opened.

Total cost: 3 600 000 DM

8. Optimisation of coal winning techniques and development of new equipment (StBV)

The topic of this project is the systematic improvement of operating techniques in ploughing and shearing, the development of a new plough system in the form of a combination of the "Gleithobel" and a conventional plough, and the further automation of face operations.

Total cost: 10,250,000 DM

9. Automation of coalwinning (NCB)

The reliability of face equipment will be improved by a new optical technique for face alignment, by the development of a drum shearer with equipment for cutting at face ends, by the improvement of face conveying equipment, and by experiments on cableless power supply for winning machines

Total cost : 1,597,110 £

10. Use of fire-resistant fluids in slow-running hydraulic motors (KSM)

This project is concerned with the extension of existing work on the development of an integrated system for hydraulic operation of face conveyor and plough which will make possible an equal sharing of the load between main and auxiliary power supplies.

Total cost: 8,500,000 FB

11. Improvement of T-junctions (StBV)

and

12. The improvement of face ends (NCB)

This is a Community project from StBV and the NCB, which is aimed at better solutions to the problems of T-junctions. On one hand, the development and testing of new machineries is planned and, on the other hand, systematic experiments on rock behaviour as the basis for new support systems at face/roadway intersections

Total cost: 3,000,000 DM

and 1,073,000 £

Programme "Outbye services underground"

This programme contains six projects aimed at the improvement of conveying and transport systems on one hand, and at the extension of modern methods of data transmission on the other.

13. Improvement of the operating characteristics of conveyor belts with high-strength reinforcement (StEV)

The suitability of new conveyor belts with high-strength textile reinforcement (tensile strength up to 2000 kp/cm of belt width) will be assessed by static and dynamic tests.

Total cost: 1 500 000 DM

14. Trackless haulage technology (StBV)

15. Rationalisation and modernisation of manriding and equipment transport (CERCHAR)

16. Mine roadway floor stabilisation (NCB)

These form three parts of a Community project concerned with the further application of trackless haulage technology originally developed in France. In particular, the prerequisites for the utilization of diesel vehicles under various conditions will be clarified. The first requirement for this is the good condition of the roadway.

Total cost: 3,900,000 DM  
2,499,400 FF  
323,500 £

17. Underground radio: data transmission and processing (INLEX)  
and

18. Control of colliery operations (NCB)

This Community project of INLEX and the NCB is aimed, in addition to the further development of various aspects of communications and data transmission, at developing a system which will require only a single cable for the purposes of verbal communication, data transmission, monitoring and remote control.

Total cost: 32,000,000 FB  
1,500,000 £

Programme "Mechanical coal preparation"

This programme consists of two projects which are aimed at improved treatment of the ever-increasing quantities of fine coal and the measurement of sulphur content which is becoming more important on environmental grounds.

19. Optimisation of the preparation of washing water and other suspensions (StBV)

This project, aimed at improving water clarification and the preparation of fines by further developments and new developments in clarification equipment, will take account of the constantly-increasing amount of coal that must be treated and the similarly increasing quantity of fine material.

Total cost: 1 750 000 DM

20. Continuous determination of sulphur content (NCB)

This project is concerned with the testing and further development of two techniques (thermal neutrons and X-ray fluorescence) for rapid, continuous determination of the sulphur content of raw and washed coal for better adaptation to increasing market requirements and environmental protection.

Total cost: 291 160 £

IV. Estimated cost and duration of the programme

The estimated total cost of the programme is

20 105 000 EUA\*

The cost and duration of the individual projects are summarised in the following table:

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\*Based on the conversion rates from national currencies to EUA on 8 November 1976

Project	Proposer	Duration years	Total Cost EUA*
<u>Methane studies, climatic problems, rock pressure and supports</u>			
1. Development of methods of controlling methane	CERCHAR	2	381 000
2. Control of mine climate in the presence of high rock temperatures and high-output operation	StBV	3	822 500
3. The use of chilled dust suppression water and other techniques to control heat emission on the coal face	NCB	3	275 000
4. Improved stability of walls and roofs	CERCHAR	2	994 000
5. Face and roadway stability: geological criteria	NCB	3	81 000
6. Prediction of strata stability from instrumentation and modelling data	NCB	4	121 500
			2 675 000
<u>Methods of working and techniques of coalgetting</u>			
7. New coalwinning and transport systems for inclined seams	StBV	3	1 345 500
8. Optimisation of coalwinning techniques and development of new equipment	StBV	3	3 830 500
9. Automation of coalwinning	NCB	3	2 343 500
10. Use of fire-resistant fluids in slow-running hydraulic motors	KSM	3	207 000
11. Improvement of T-junctions	StBV	3	1 121 500
12. The improvement of face ends	NCB	3	1 574 500
			10 422 500

\* Based on the conversion rates from national currencies to EUA on 8 November 1976

Project	Proposer	Duration years	Total cost EUA*
<u>Outbye services underground</u>			
13. Improvement of the operating characteristics of conveyor belts with high-strength reinforcement	StBV	3	561 000
14. Trackless haulage technology	StBV	3	1 457 500
15. Rationalisation and modernisation of manriding and equipment transport	CERCHAR	2	452 500
16. Mine roadway floor stabilisation	NCB	2	475 000
17. Underground radio: data transmission and processing	INTEX	3	779 000
18. Control of colliery operations	NCB	3	2 201 000
			<hr/> 5 926 000
<u>Mechanical coal preparation</u>			
19. Optimisation of the preparation of washing water and other suspensions	StBV	3	654 000
20. Continuous determination of sulphur content	NCB	3	427 500
			<hr/> 1 081 500
			<hr/> 20 105 000

\* See page 11

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V. Research results

The E.C.S.C. Experts' Committees which are already concerned with all research work in the four fields of the new programme will also supervise and keep under review the execution of the research work that forms the subject of the requests.

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 interested parties in the Community, in accordance with Art. 55 of the E.C.S.C. Treaty.

VI. Expected consequences of the new programme

The expected repercussions of the research work in the proposed programme will make themselves felt in three directions:

The research on methane, mine climate and rock pressure (Projects 1 to 6) deserve particular mention in relation to mine safety and working conditions. These can contribute especially to the prevention of accidents and to the creation of more tolerable environmental conditions. In addition to this major aspect, the studies mentioned will help to establish the conditions necessary for coalwinning at greater depths or under more severe conditions in the future.

This is also true for the work on improvement of T-junctions (projects 11 and 12), on further development of underground communications (17 and 18), and on the introduction of trackless haulage (14 to 16) which, besides improving operations, will also contribute to the improvement of mine safety and the optimisation of working conditions (reduction of the danger of accidents at face ends, safer transmission of information, quicker and more comfortable personnel transport).

Finally, project no. 20 is of special importance for the environment since it will make possible continuous observation of the sulphur content of raw and washed coal and will also make easier the introduction of any necessary measures.

From the technical point of view, two features are important in relation to supports. First, the projects on winning in inclined seams (No. 7) and the further optimisation and automation of face operations (Nos. 8 to 10) will contribute towards the extension of the outstanding performances already achieved in other types of seam, thus enabling better exploitation of seams and improved safety in workplaces to be achieved. Secondly, projects 10 and 11 should be mentioned, since these will make possible better solutions to the problems of face/roadway intersections which have hitherto not been solved satisfactorily. In the field of outbye operations, the installation of new conveyor belts (Project No. 13) will make it possible to adapt conveying equipment to constantly increasing throughputs. This project also has a safety aspect because it will be possible to use these belts for manriding. The same is true for projects Nos. 14 to 16 whose aim is the widespread introduction of trackless transport with its advantages for rapid equipment movement and safe manriding. The two projects on further use of telecommunications (Nos. 17 and 18) will have, besides their effect on improved and faster control of operations, an important influence on mine safety through more reliable monitoring of environmental conditions.

Finally, from the economic point of view, a direct or indirect influence on the improvement of operational results is to be expected from all projects. Project No. 19 should be mentioned here particularly since, in view of the increasing fines content of raw coal, it has great importance for the preparation of both coking coal and power-station coal.

## VII. Conclusions

In view of the interest and importance of the proposed research programme with regard to technology, safety, working conditions, protection of

the environment and the economy of underground and surface operations in the Community's coal mines, the provision of financial aid by the E.C.S.C. for the execution of each of the projects is judged to be appropriate and justified.

The total cost of the research programme will be 20 105 000 EUA and the Commission proposes to grant aid totalling 12 063 000 EUA to cover its share of the research expenditure.

Distribution of aid

CERCHAR (France)	1 096 500 EUA
INLEX (Belgium)	467 400 EUA
KSM (Belgium)	124 200 EUA
NCB (Great Britain)	4 449 400 EUA
StBV (Germany)	5 875 500 EUA

M E M O R A N D U M

CONCERNING A COMMUNITY COAL RESEARCH PROGRAMME IN THE FIELD OF PRODUCT BENEFICIARIES  
WITH A VIEW TO OBTAINING FINANCIAL AID UNDER THE TERMS OF ARTICLE 55 § 2 c)  
OF THE E.C.S.C. TREATY

(Budgetary year 1977)

I. General remarks

The course of events since the beginning of the energy crisis in 1973 has shown that coal can, and should, play a larger part in meeting future energy requirements than had previously been envisaged, and that the use of indigenous reserves should be optimised to reduce the Community's dependence on external supplies of energy and raw materials. Extensive and coordinated research efforts are required in two main areas to enable Community coal resources to be used to the best advantage. First of all it is necessary to ensure that coal can be extracted efficiently at an economic cost and, at the same time, that working conditions and safety in the mining industry are improved. Secondly, research is needed to maintain and improve the market for coal by improving its utilization so that it can try to play a competitive rôle in the medium term in the traditional fields of coke manufacture and electricity generation and so that, in the longer term, it can be used successfully as a source of chemicals and liquid and gaseous fuels.

The Commission has already played an active part in encouraging the development of new and improved carbonization techniques aimed at improving the efficiency and economy of metallurgical coke production and at enabling a wider range of cheaper and more abundant types of coal to be used in coke manufacture. A continuing effort is required to ensure that the best use can be made of such techniques, to further their development, and to solve the new range of problems that arises in their application. Investigations are also needed to improve the upgrading of carbonization by-products and the control of pollution, not only in the coking industry but also in other coal conversion processes.

The results of such studies will lead to improvements in the economy of coke production, and in working conditions and environmental control, thus benefiting both the steel industry and the Community at large.

Research in the field of coal combustion will help to ensure that coal can continue to compete, in terms of economy, convenience and environmental acceptability, with other fuels for the generation of electricity and for other purposes. In future years, coal will be used as a source of gases, liquid fuels and chemical raw materials and the research that has been initiated into the conversion of coal for these purposes must be continued to ensure that the necessary technology will be available when it is required.

The safe disposal of colliery spoil presents a serious technical and economic problem for the mining industry. The Community therefore has a strong interest in research concerned with the treatment of spoil to produce upgraded materials and with finding new uses for the resulting products. The aim of such research is not only to alleviate the problem of spoil disposal but also to find profitable outlets for this undesirable waste material.

The Community has already given financial assistance to programmes of research in the field of product beneficiation, and the following Community institutions :

The Centre d'Etudes et Recherches des Charbonnages de France, Paris (CERCHAR)

The Centre de Recherches Métallurgiques, Liège (CRM)

The Centro Sperimentale Metallurgico, Roma (CSM)

The Deutscher Braunkohlen-Industrie-Verein, Köln (DEBRIV)

The International Flame Research Foundation, IJmuiden (IFRF)

The National Coal Board, London (NCB)

The National Carbonising Company, Ltd, Mansfield (NCC)

National Smokeless Fuels, Ltd, London (NSF)

The Steinkohlenbergbauverein, Essen (StBV)

have submitted requests for financial aid under the terms of Article 55 § 2 c) of the E.C.S.C. Treaty for further research projects in this field.

The projects which form the subject of these requests form two Community programmes of research in the fields of coking and briquetting of coal, and new chemical and physical processes and products from coal which are a logical extension of earlier Community programmes but which also include new elements.

The allocation of tasks within the programme takes account of the facilities and expertise existing in the various Community countries, and a close collaboration between research workers and coal producers is assured.

## II. Aims and objectives of the programme

The research projects in the field of product beneficiation for which aid is requested are related to two main topics, and thus form two programmes :

- the coking and briquetting of coal, and
- new chemical and physical processes and products from coal.

The performance and fuel consumption of blast furnaces, and hence the cost of steel production, are affected by changes in the quantity and quality of the mineral constituents of the coking coal and coke used by the steel industry, and the research programme in the field of coking and briquetting of coal includes a project whose aim is to develop a new, rapid analytical technique which will enable quality control in the production and utilization of coke to be improved. Considerable progress has been made in coking technology in recent years, notably in the use of larger ovens, charge preheating and high-intensity carbonization, and the Community has taken great interest in such developments. The research programme includes a number of projects related to these techniques. The safety of coke oven operation and the range of coals that can be carbonized successfully are affected by the phenomenon of pressure exerted by the coal charge on the oven walls, and it is proposed to develop a simple laboratory test for rapid assessment of this problem when preheated coal blends are used. The efficiency of coke oven operation, the quality of the coke produced and atmospheric pollution during oven discharge are influenced by the uniformity of oven heating and it is planned to apply an experimental technique, already used successfully for conventional ovens, to tall ovens where the problem of uniform temperature distribution is more severe. Aid is requested for a continuation and extension of current basic studies of the properties and carbonization behaviour of coal blends aimed at widening the range of coals that can be carbonized, as well as for pilot- and industrial-scale investigations of a new technique for increasing the amount of cheap non-coking coal that can be incorporated into blends for the manufacture of blast furnace coke.

It is also proposed to carry out studies aimed at improving the control and automation of the coking process, with particular reference to the use of charge preheating, high-intensity carbonization and a wider range of coals. In the field of carbonization by-products it is intended to develop a new process for ammonia recovery which will use smaller amounts of energy and water than conventional methods, and to investigate the recovery of chemicals from the by-products of low-temperature carbonization. The latter project has particular relevance to the manufacture of formed coke. The Community has already financed studies of the production of small-sized coke from lignite for use as a cheap, non-polluting fuel in the metallurgical industry and it is proposed to continue, on the demonstration scale, investigations into the new process that has been developed. The last project in this programme is concerned with environmental protection. It is concerned with improved purification of liquid effluents from coking plants and forms a logical complement to studies that are already supported in this field.

The programme in the field of new chemical and physical processes and products from coal contains a proposal to continue current studies of gasification in fluidised beds, aimed at developing a cheap, efficient and clean system for generating electricity from coal. The Community has already supported research into the liquefaction of coal by extraction with supercritical gases as a means of producing chemicals and liquid fuels, and aid is now requested for studies in connection with the development of a pilot plant for this process. Hydrogenation provides an alternative method of producing chemicals from coal which could replace oil products, and it is intended to pursue the study of low-cost hydrogenation processes on the laboratory- and pilot scales. The disposal, utilization and upgrading of waste materials from the mining industry presents a continuing problem, and the research programme includes two new projects related to this topic. The first deals with the manufacture of a dense aggregate from colliery spoil, while the second is concerned with investigations into the utilization of light sands and aggregates made from the same raw material by processes that have been developed with aid from the Community. A number of new uses will be studied. Community aid has already been given for research aimed at improving the convenience and competitiveness of coal-fired equipment in the industrial and quasi-domestic market, and it is planned to continue this work in a further project. A second proposal in the field of combustion deals with pilot-scale studies of the combustion of high ash coal in the electricity and cement industries. The study is aimed at facilitating the use of cheaper coals in these large markets, and at improving the efficiency of energy utilization. Finally, it is proposed to continue existing studies of pollutants formed during the coal processing (including carbonization) which present potential health hazards.



III. Programme of work envisaged

The proposed research programme in the field of product beneficiation can be summarised as follows :

Programme "Coking and briquetting of coal"

Properties of coking coals and carbonization products

1. Direct analysis of coal and coke mineral constituents using the glow discharge technique (GSM)

Development of a technique for rapid analysis to replace traditional methods for determining the inorganic constituents of coal and coke in order to improve quality control and the efficiency of coke utilization.

Total cost : 152,000,000 Lit

Development of conventional coking techniques

2. Development of a laboratory test to detect the dangers of pressure in preheated blends (CERCHAR)

Extension of a small-scale test, originally developed for conventional, wet coal blends, to detect the danger of pressure in the carbonization of preheated blends, and thus to provide a low-cost, routine test for use in coking plant laboratories.

Total cost : 1,151,440 FF

3. Vertical temperature distribution and its improvement in tall ovens (CERCHAR)

Tests on models and industrial coke ovens to improve the uniformity of heating in tall ovens, aimed at improving the efficiency and economy of operation, reducing pollutant emission during oven discharge, and improving the homogeneity of the coke produced.

Total cost : 2,151,090 FF

4. Relationship between properties of coke oven blends and coke product (NCB)

Extension of previous studies to include prediction of the quality of coke made from coal blends, taking into account the rate of carbonization and the interactions between the mineral matter contents of the coals. Study of factors responsible for the formation of fissures and cracks in coke to solve practical problems of blend formulation and optimisation of coke quality, and thus to extend the range of coals that can be carbonized.

Total cost : 500,000 £

5. Blast furnace trials with coke manufactured in conventional ovens from blends containing briquettes of non-coking coal (CRM)

Extension of the range of coals <sup>that</sup> can be carbonized in conventional coke ovens by manufacturing coke from coking coal blends incorporating briquettes made from non-coking coals. Blast furnace trials (financed separately) with the coke produced.

Total cost (excluding blast furnace trials) : 41,200,000 FB

6. Contribution to the process control <sup>of</sup> coking plant operation (StBV)

Investigation aimed at the development of off-line control of coking plants by improvement of the mathematical description of the coking process, of methods of temperature measurement and control, and of machine control equipment.

Total cost : 2,417,000 DM

Production and beneficiation of by-products and coking gas

7. Recovery of ammonia from coke oven gas using ammonium sulphite (StBV)

Development of a new process for ammonia production to reduce energy consumption and to improve water utilization in the washing of coke oven gas.

Total cost : 1,500,000 DM

8. Recovery of phenols from tar and aqueous effluent (NCC)

Study of methods of recovery of phenols from tar and liquor produced during the low-temperature carbonization of coal (e.g., in smokeless fuel and formed coke processes).

Total cost : 67,000 £

New methods of coking coal

9. Manufacture of granular coke in a rotating hearth oven (DEBRIV)

Continuation, on the demonstration plant scale, of research into the production of small-sized coke from lignite for use in the metallurgical industry by a new process that can also be applied to other coals.

Total cost : 1,200,000 DM

Technical and economic problems in environmental protection

10. Investigation of the possibility of improving the final treatment of coking plant effluent by secondary biological processing (CERCHAR)

Study of secondary physico-chemical and biological treatment of liquid effluents to eliminate impurities that cannot be removed by normal biological treatment.

Total cost : 1,065,000 FF

Programme "New chemical and physical processes and products from coal"

Gasification

11. Production, preparation and utilization of gas from coal (NCB)

Continuation of existing work on the development of a fluidised bed process to gasify coal under pressure with air and steam in order to produce a clean fuel gas suitable for combined cycle electricity generation.

Total cost : 1,388,000 £

Dissolving coal and extracting constituents

12. Solution of coal in supercritical solvents : depressurising particulate solids (NCB)

Development, in connection with current studies of coal liquefaction, of methods for depressurising the solid product obtained by the extraction of coal with supercritical gases, with a view to use in a pilot extraction plant or in other high-pressure coal treatment processes.

Total cost : 397,000 £

Hydrogenation and hydrocracking of coal, extraction products and tar aromatics

13. Valorisation of coal by hydrogenation (StBV)

Development of new and more economic processes for coal hydrogenation, and of standard techniques for product analysis. Investigation of new or improved processes for further hydrogenation to give chemical raw material, especially aromatic compounds. Investigation of the use of coke oven gas as a cheap source of hydrogen.

Total cost : 1,580,000 DM

Building and other materials from coal and shale

14. Beneficiation of colliery spoil by conversion into aggregate (NCB)

Extension of current investigations into spoil utilization. Definition of a process for using washery shale to manufacture a strong dense aggregate for use in concrete in order to meet anticipated shortages of natural aggregates and to dispose effectively of a waste material from the coal industry.

Total cost : 314,000 £

15. Spoil upgrading (CERCHAR)

Further development of existing studies on the preparation and utilization of upgraded materials (light sands and aggregates) from colliery spoil. Investigation of a wide variety of uses for the product.

Total cost : 2,093,600 FF

Improved methods of combustion and utilization of heat

16. Improved industrial appliances for coal (NCB)

Continuation, using boiler test facilities of up to 3 MW capacity, of studies aimed at improving the competitive position fo coal in the industrial and quasi-domestic market by development to reduce capital and labour costs while meeting environmental control requirements.

Total cost : 392,000 £

17. A proposed experimental investigation to provide data for improved combustion performance of higher ash coals in pulverized coal firing (IFRF)

Pilot-scale investigation of problems related to the combustion of high ash coals in conventional equipment, particularly in the electricity generation and cement manufacturing industries, with a view to reducing fuel cost and saving energy.

Total cost : 1,458,000 Hfl

Technical and economic problems in environmental protection

18. The estimation of polynuclear aromatic hydrocarbons and their aza derivatives formed during coal processing (NCB/NSF)

Development of methods of sampling, identification and determination of polynuclear aromatic hydrocarbons and their aza derivatives in products from the processing of coal for the assessment of health hazards that can occur during the manufacture and use of coal products.

Total cost : 189,000 £

IV. Estimated cost and duration of the research work

The total cost foreseen for the programme is 10.120.000 E.U.A.

The cost and duration of the individual projects is given in the following table.

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\*) Rates of conversion from national currencies use those of 8.11.1976

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Projects	Proposer	Duration (years)	Total cost
			E.U.A. *)
<u>Coking and briquetting of coal</u>			
<u>Properties of coking coals and carbonization products</u>			
1 Direct analysis of coal and coke mineral constituents using the glow discharge technique	CSM	2	159.000
<u>Development of conventional coking techniques</u>			
2 Development of a laboratory test to detect the dangers of pressure in preheated blends	CERCHAR	2½	298.000
3 Vertical temperature distribution and its improvement in tall ovens	CERCHAR	3	389.500
4 Relationship between properties of coke oven blends and coke product	NCB	3	734.000
5 Blast furnace trials with coke manufactured in conventional ovens from blends containing briquettes of non-coking coal	CRM	4	1.000.000
6 Contributions to the process control of coking plant operation	StBV	3	903.500
<u>Production and beneficiation of by-products and coking gas</u>			
7 Recovery of ammonia from coke oven gas using ammonium sulphite	StBV	2	561.000
8 Recovery of phenols from tar and aqueous liquor effluent	NCC	3	98.500
<u>New methods of coking for coal</u>			
9 Manufacture of granular coke in a rotating hearth oven	DEBRIV	2	448.500

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N°	Projects	Proposer	Duration (years)	Total cost
				E.U.E. *)
	<u>Technical and economic problems in environmental protection</u>			
10	Investigation of the possibility of improving the final treatment of coking plant effluent by secondary biological processing	CERCHAR	2	193.000
	Total			4.695.500
	<u>New chemical and physical processes and products from coal</u>			
	<u>Gasification</u>			
11	Production, preparation and utilization of gas from coal	NCB	3	2.037.000
	<u>Dissolving coal and extracting constituents</u>			
12	Solution of coal in supercritical solvents: depressurising particulate solids	NCB	3	582.500
	<u>Hydrogenation and hydrocracking of coal, extraction products and tar aromatics</u>			
13	Valorisation of coal by hydrogenation	StBV	3	590.500
	<u>Building and other materials from coal and shale</u>			
14	Beneficiation of colliery spoil by conversion into aggregate	NCB	2	461.000
15	Spoil upgrading	CERCHAR	2	379.000
	<u>Improved methods of combustion and utilization of heat</u>			
16	Improved industrial appliances for coal	NCB	3	575.500
17	A proposed experimental investigation to provide data for improved combustion of higher ash coals in pulverized coal firing	IFRF	3	521.500

Continued

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N°	Projects	Proposer	Duration (years)	Total cost E.U.A. (*)
18	<u>Technical and economic problems in environmental protection</u> The estimation of polynuclear aromatic hydrocarbons and their aza derivatives formed during coal processing	NCB/NSF	3 1	277.500
	Total			5.424.500
	Grand total			10.120.000

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(\*) The rates of conversion from national currencies are those of 8.11.1976

#### V. Research results

The E.C.S.C.'s Experts' Committees which are already concerned with all research work in these fields will also supervise and keep under review the execution of the research work that forms the subject of the requests.

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 interested parties in the Community, in accordance with Art. 55 of the E.C.S.C. Treaty.

#### VI. Technical, economic, social and environmental repercussions of the research programme

In the technical and economic spheres the expected results will benefit the Community's coal industry by :

- improving the quality of coke and the utilization of coal and coke in the production of steel,
- increasing the safety and efficiency of coke oven operation and facilitating the application of the most recent developments in coking technology,
- improving the utilization of the Community's coal reserves by widening the range of coals that can be carbonized successfully,
- improving the recovery of valuable carbonization by-products,
- developing new processes for the production of chemicals and solid and liquid fuels from indigenous raw materials, thus reducing the Community's dependence on external supplies,
- increasing the efficiency of energy utilization and improving the competitive position of coal vis à vis other fuels for heating, electricity generation and cement manufacture,
- providing profitable outlets for the waste products of the mining industry,
- helping to solve technical problems of air and water pollution in coal processing and utilization.

From the social and environmental points of view, benefits to the Community are expected from :

- reduction in the incidence of air and water pollution in coal processing and utilization, and particularly in coke manufacture with consequent improvements in both working conditions and the general environment,
- improved understanding and assessment of potential health hazards in coal processing,
- reduction or elimination of the need for unsightly and potentially dangerous spoil tips by the development of upgraded products from colliery spoil and of new uses for such products.

#### VII. Conclusions

For the reasons outlined above, the provision of financial aid by the Community for the proposed research work in the field of coking and briquetting of coal and new chemical and physical processes and products from coal is judged to be appropriate and justified.

The research programme will cost 10.120.000 EUA and the Commission proposes to grant aid totalling 5.972.000 EUA

#### Distribution of aid

CERCHAR (France)	702.000 E.U.A.
CRM (Belgium)	500.000 E.U.A.
CSM (Italy)	95.400 E.U.A.
DEBRIV (Germany)	269.100 E.U.A.
IFRF (Netherlands)	312.900 E.U.A.
NCB (Great Britain)	2.800.000 E.U.A.
NCC (Great Britain)	59.100 E.A.U.
StBV (Germany)	1.233.000 E.U.A.

N.B. Rates of conversion from national currencies are those of 8.11.1976

