COMMISSION OF THE EUROPEAN COMMUNITIES

COM (81) 229 final

Brussels, 6 May 1981

SUBSTITUTION OF COAL FOR OIL IN "OTHER INDUSTRY"

(Communication from the Commission to the Council)

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(1) The Member States of the European Community have set themselves the objective of reducing their dependence on oil imports. Visible progress has been made in energy-saving, but the decisive turning-point in terms of introducing substitutes for oil has not yet been reached. For this, the patterns of consumption have to be changed; more use must be made of alternative sources of energy (coal, nuclear energy). This type of structural change must therefore be encouraged in the industrial sector. The European Council of 27 and 28 April 1980 in Luxembourg, and the Western Economic Summit of 22 and 23 June 1980 in Venice, put out very detailed statements on this subject and expressly recommended a return to coal.

(2) Figures for the potential replacement of oil by coal have been given in some international publications; but, except in the electricity sector, there are few precise ideas about the sectors of consumption in which this objective can be achieved and the technical and energy-policy measures required. The heat requirements of "other industry"[1] form one sector in which coal has suffered particularly serious losses in its share of the market over the past twenty years, initially to fuel oil and subsequently to natural gas. Because of the large number of energy-consuming firms, the variety of energy-consuming plant and, not least, the fact that the statistics are insufficiently broken down, it is also a sector in which it is difficult to obtain an overall view.

(3) The Commission has therefore examined the scope for replacing oil by coal in "other industry". It has prepared a report describing at some length the problems involved. The following paragraphs summarise the contents of the report and suggest a number of points for consideration by the Council.

[1] Statistically speaking, all branches of industry except the energy sector, the steel industry and small industry and crafts.

(4) The calculated replacement potential in the heating requirements of "other industry" appears considerable when it is recalled that coal and coke accounted for 60% of the thermal consumption of this sector in 1960 compared with no more than 9% in 1978 (11 million toe). However, this does not mean to say that coal can make up the ground that is has lost. The situation of supply and demand has changed too much for that; moreover, it will continue to change. The industrial production apparatus, the manufacturing processes and the range of industrial products have changed and will continue to change, precisely because of the need to adopt energy-saving production techniques. In addition, natural gas is an extremely strong competitor to coal, particularly so long as the existing price differential remains.

(5) The only branch of industry in the Community which has so far reverted to coal to any great extent is the cement industry. This industry cannot, however, be taken as representative since its situation as to fuel costs, quality requirements for the coal used and utilisation of the resulting ash (environmental protection) is not the same for other industries.

(6) Although it is impossible to make reliable forecasts, market forces and further refinement of coal-handling and -firing techniques in the course of time can be expected to lead to an increasing use of coal in "other industry". However, on the basis of the energy-policy data now available, it seems clear that, for economic and ecological reasons, this process will be slow. The reasons are as follows:

- The current heat-price ratio between coal and fuel oil is not by itself sufficient to persuade the potential investor to switch to coal. Firstly, the general investment climate is suffering from too many uncertainties regarding economic trends and long-term economic policy. Secondly, the firms are more concerned about their future competitivity than the long-term security of their energy supply. Where firms are investing, production apparatus is given priority over industrial energy-consuming plant.

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- The costs for conversion from oil to coal are certainly very high and represent an obstacle. They are difficult to forecast because they depend on the type of investment (new installation, conversion or reconversion of existing equipment) and vary with the size of the boiler. Smaller installations are relatively more expensive than bigger ones. Data available show that the reconversion of a boiler utilizing 50,000 to 100,000 tonnes of coal per annum may necessitate a capital expenditure of 150 to 300 ECU per tonne of oil to be substituted; the conversion of an oil-fired boiler may even cost 300 to 500 ECU per tonne of oil replaced.

- Industrial energy-consumers often have no experience of using coal, especially in countries with a low consumption of coal. This gives rise to a number of reservations which appear insurmountable for psychological reasons. There is a lack of confidence in available technologies and reluctance to use a bulk mineral commodity such as coal. Finally, there are no other plants to serve as an example when seeking information about the appropriate solution for individual case.

- The insecurity felt by industrial energy-consumers as a result of public opinion about the environment and the wait-and-see attitude adopted in energy policy should not be underestimated. Investors are no longer able to make an accurate assessment of the framework of data imposed on them (application of environmental and safety regulations, authorization procedures, etc.).

- Industry has put more and more new fuel-oil and gas boilers into service over the past ten to twenty years. These boilers often are not suitable for conversion to coal; in many cases, they have not reached the end of their useful life. The question of replacing them will not arise until well into the future. Coal-fired boilers are also relatively expensive while the proportion of total production costs accounted for by fuel costs is relatively low; no direct economic advantages can therefore be expected here from changing the source of energy used.

- Existing boiler technology and, in some cases, environmental regulations require the use of suitably cleaned and sized coal; supply is limited and prices are higher. This reduces coal's price advantage over fuel oil.

(7) In these circumstances, it is for consideration what measures must be taken to introduce or to speed up the desired structural change.

The most important condition is that coal should remain attractive to the consumer as a secure and cheap source of energy. In the Commission's view, the conversion process should be encouraged by additional measures on a national as well as a Community level. For this purpose, the following possibilities should be investigated:

- investment incentives;

- promotion of coal-fired reference plant to demonstrate existing coal-firing technologies in regions where these have not yet been applied;

- promotion of new coal-firing technologies using all coal available on the market (usual R & D incentives, support for the construction of demonstration plant);

- converting the heating of public buildings to coal-firing (although this does not come under the branch of industry in question, an example of this type would have a considerable effect);

- promotion of investment in the infrastructure of the carriage and transshipment of coal, right down to the final consumer, including the elimination of legal, administrative or customary-law barriers to optimum utilisation of existing plant;

- improvement of market transparency by publishing comprehensive price comparisons for the various sources of energy at the stage of final consumption;

- clear policy guidelines for environmental protection, reconciling environmental interests with the requirements of energy policy and competitive production. This includes the establishment of standards and building regulations which are precise, realistic and not subject to frequent change;

- better provision of information for industrial energy-consumers on existing technologies, coal qualities and other relevant data by means of conferences, exhibitions, etc.

(8) The Commission requests that the Council should, on 9 June 1981, hold a general exchange of views on these suggestions. Thereafter, the Commission will make specific proposals for Community action as appropriate.

R E P O R T

on

the substitution of coal for oil in

"other industry"

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I. INTRODUCTION

1. In the fifteen years from 1958 to 1973, coal quickly lost ground to oil as a fuel on the Community energy market. On the one hand, this was due to the increasingly attractive price of oil. On the other hand, the use of oil offered advantages such as a higher calorific value, lower capital costs, more compact firing units, lower operating and labour costs and no problems with ash. Coal's share of total primary energy consumption in the Community thus fell from 57% in 1958 to 19% in 1978; this percentage first fell beneath 50% in 1961.

2. The rapid increase in oil prices since 1973 and the growing uncertainty surrounding supplies have led to a number of political statements - most recently at the two summit conferences in Venice[1] - indicating the need to review coal's role as a source of thermal energy and to use more coal instead of oil in industry in general, if need be with the aid of tax incentives. The Council of the European Communities has stressed - most recently in its Resolution of 9 June 1980 on energy objectives - that an attempt should be made to reduce oil's share of gross energy consumption to 40% by 1990.

3. On the basis of the shift in energy policy, various publications have attempted to forecast potential coal trends at the world or international level. These publications include:
   - "Medium-term guidelines for coal"[2] (Commission)
   - "Steam coal, prospects to 2000"[3]
   - "Coal - bridge to the future"[4]
   - "Outlook for the long-term coal supply and demand trend in the Community"[5]

   All these publications deal with coal markets as a whole, major sectors of use and problems of infrastructure and production.

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[1] Heads of State and Government of the Community: 12-13 June 1980, Western Economic Summit: 22-23 June 1980

[2] OJ C 22 of 30.1.1975.

[3] IEA/OECD - Paris 1978.

[4] Massachusetts Institute of Technology 1980 (WOCOL).

[5] COM(80)117 final.

4. These studies indicate that there should be no doubt that electricity generation will be the biggest market for steam coal, at least until the end of the century. Irrespective of this, increased use of coal in the "other industry" sector could also help reduce the Community's dependence on imported oil. A report[1] by the ECSC Consultative Committee refers to the future importance of replacing oil by coal for industrial energy consumption and recommends that the Commission examine substitution possibilities in the industrial steam-raising market.

The Association of the Coal Producers of the European Community has also worked out detailed studies on substitution problems in "other industry."[2,3] These studies give a favourable assessment of possible future coal trends and suggest how the substitution process can be launched and accelerated.

5. Various bodies and professional organisations have held public meetings, especially in the United Kingdom, France and the Federal Republic of Germany, to discuss the complicated technical and economic aspects of converting oil-fired plant to coal in the industrial sector. The sometimes extensive conference reports contain interesting findings which are merely referred to here without further detail.

6. The publications and statements have prompted the Commission to state its position on this very complicated range of problems. However, this report cannot go into details or deal with individual cases. The Community

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[1] "Medium and long-term perspectives for coal in the Community" by Mr. H.J. Thomas, OJ C 161 of 28 June 1979.

[2] Report on the prospects for coal consumption in the "other industry" sector of the Community energy market, September 1979 (unpublished).

[3] Technically possible use of coal in the "other industry" sector of the European Communities up to the year 2000, April 1980 (unpublished).

covers too large an area for this; conditions in the individual Member States, in the branches of industry and in the companies and the size, location and technical equipment of the companies vary too much for a common denominator to be found. For the same reasons the investment costs of conversion can only be treated in a very general manner. Of course, it is possible to give a general indication of the aspects on which individual companies plan their decision-making concerning the conversion of existing firing plant. In order to give the reader some idea of the range of technical and economic - and even psychological and subjective - factors which arise, Annex I lists these aspects, albeit without any claim to completeness. It is not possible to quantify these aspects or give a rational assessment of them in this study. This is not the Commission's responsibility but that of the companies themselves, the engineering consultancy services and the fuel suppliers. This study contains only an overall summary of the problems and prospects of increasing coal consumption in the industrial sector and indicates measures which could be taken to promote and accelerate the transition from oil-firing to coal-firing.

7. For the purposes of this study, the following markets are not included either because they are dealt with in other publications or because it is not yet possible to predict their technical development satisfactorily:

- the iron and steel industry and foundries;
- chemical feedstocks;
- coal gasification and liquefaction.

The household market is also excluded from this report. However, there are repeated references to the bulk heat market or to large-scale heating. This involves space heating for factories, offices, public buildings of all types and dwellings supplied by large plants with or without the combined generation of electricity. This market cannot be included

1) See Chapter II below

in the tables because of statistical difficulties, but the problems and prospects of this market are very similar to those of small and medium-sized industry. Most of the statements in this report therefore apply equally to large-scale space heating.

The report is limited in area to the nine Member States of the Community. Greece, which became a member of the Community on 1 January 1981, could not be incorporated as no complete or comparable statistics were available.

8. This report is intended to prompt general discussion in all Member States of how to overcome the current obstacles to the replacement of oil by coal and of the extent to which free market forces need to be supplemented by energy policy and other administrative measures in order to accelerate this process in the industrial sector. This report is also intended to provide general information for those industrial companies toying with the idea of converting their energy-consuming plant to coal or wishing to invest in new coal-fired plant.

II. PAST TRENDS

9. Looking back is basically of only historical significance, but the past contains important pointers for analysis of the current situation and may help to analyse it.

This analysis requires suitable statistical material enabling comparison of different periods and different countries. The field of examination must also be defined and statistically demarcated.

A. Field of examination

10. Annex II of this report contains statistical tables of the trend in final energy consumption of the "other industry" sector from 1960 to 1978, the last year for which complete statistics were available when this report was drawn up. Figures are given for the individual Member States of the Community (Table 1) as well as for the individual sources of energy and branches of industry (Tables 2-11).

The term "other industry" is used in the Community's official statistics and covers all branches of industry except the steel industry, the energy sector and small business.

The term "final energy" covers all sources of energy used in industrial production; however, non-energy consumption is excluded. The energy used by industrial self producers of electricity is also disregarded in the statistics for final energy consumption. This is in keeping with the objectives of this study which intends to analyse only the substitution procedures for covering industry's actual requirements of heat. For information purposes, Tables 2-11 of Annex II state the amounts used by industrial power plant in 1978 to give some idea of the orders of magnitude involved.

By restricting this study to industrial heating requirements and the substitution processes in this sector, we are forced to disregard electricity consumption, as electricity is used in industry for only quite specific heating processes (metallurgy), chemicals and for covering power and lighting requirements. Electricity consumption is therefore listed only in statistical table 1 of Annex II.

The "other fuels" listed in table 1(patent fuel, brown coal briquettes, derived gases, etc.) are also disregarded as they are relatively unimportant for the substitution procedures.

This leaves the study with the following major competing energy sources: 1)

hard coal
coke
light fuel oil
heavy fuel oil
natural gas.

"Other industry" in the Community used 123.1 million toe of these energy sources in 1978. This quantity is equivalent to 94% of the thermal final energy consumption of "other industry". The figures contained in Tables 2-11 of Annex II break down this market according to Member State and individual branch of industry whenever these statistics were available or of significance for the study.

11. All the figures are expressed in toe (tonnes oil equivalent). As various statistical bases analysed contained figures in toe or t=t, these figures had to be converted or rounded off so that the aggregation of the individual figures does not always tally with the totals.

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1) A large proportion of these figures are our own assessments, since we had to disregard industrial self producers of electricity and differentiate between light and heavy fuel oil.

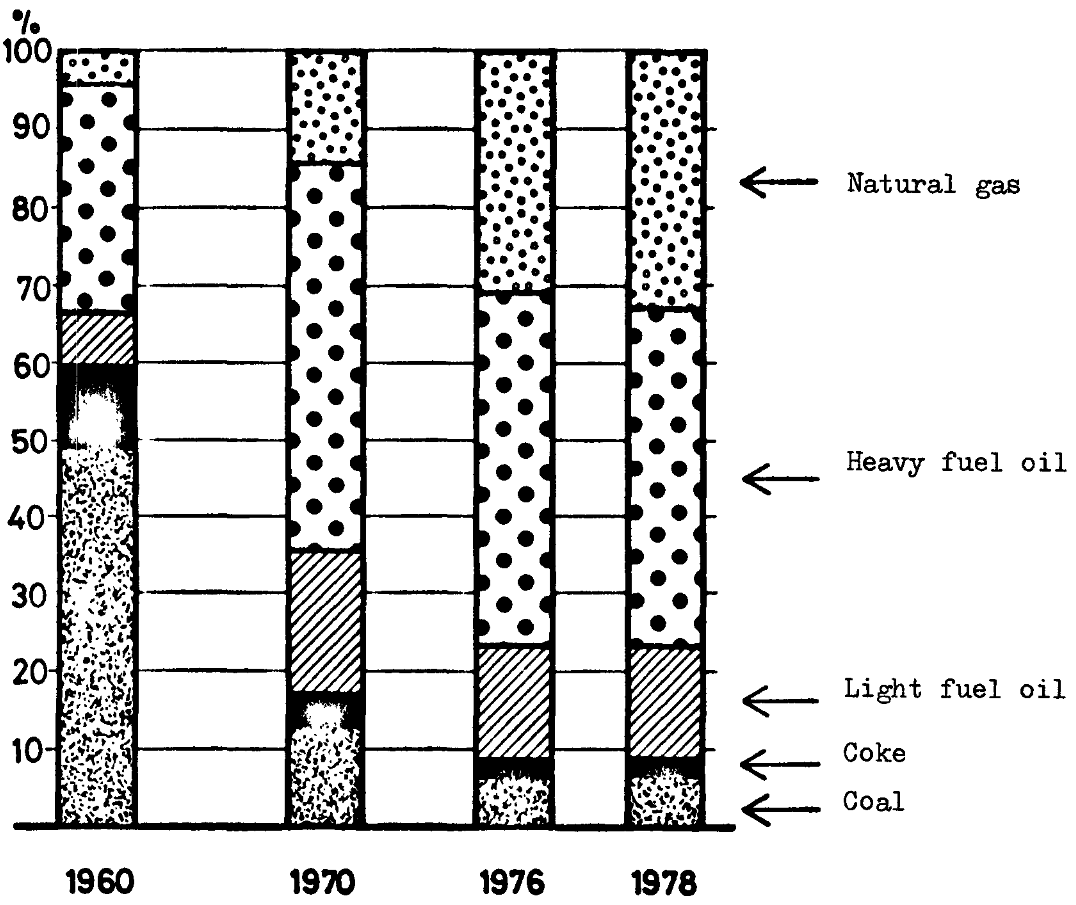
B. Historical background

12. Two stages of development stand out when examining the substitution processes in "other industry". Coal, which still covered almost half of energy demand in 1960, was largely ousted by oil by 1970. The most important feature of the trend in the seventies was the advance of natural gas which not only ate further into coal's share of the supply market but also increasingly replaced light and heavy fuel oil. Since 1976 there has been a slight increase in the use of coal (see Figure A and Table 2 of Annex II).

Figure A

Final consumption of selected energies in "other industry" in the Community

(Percentage shares)



In 1960 hard coal and coke still accounted for 59.3% (about 49 million toe) of total thermal consumption; by 1978 this figure had dropped to 8.8% (around 11 million toe).

The reasons behind this trend are known; they were already mentioned in the introduction.

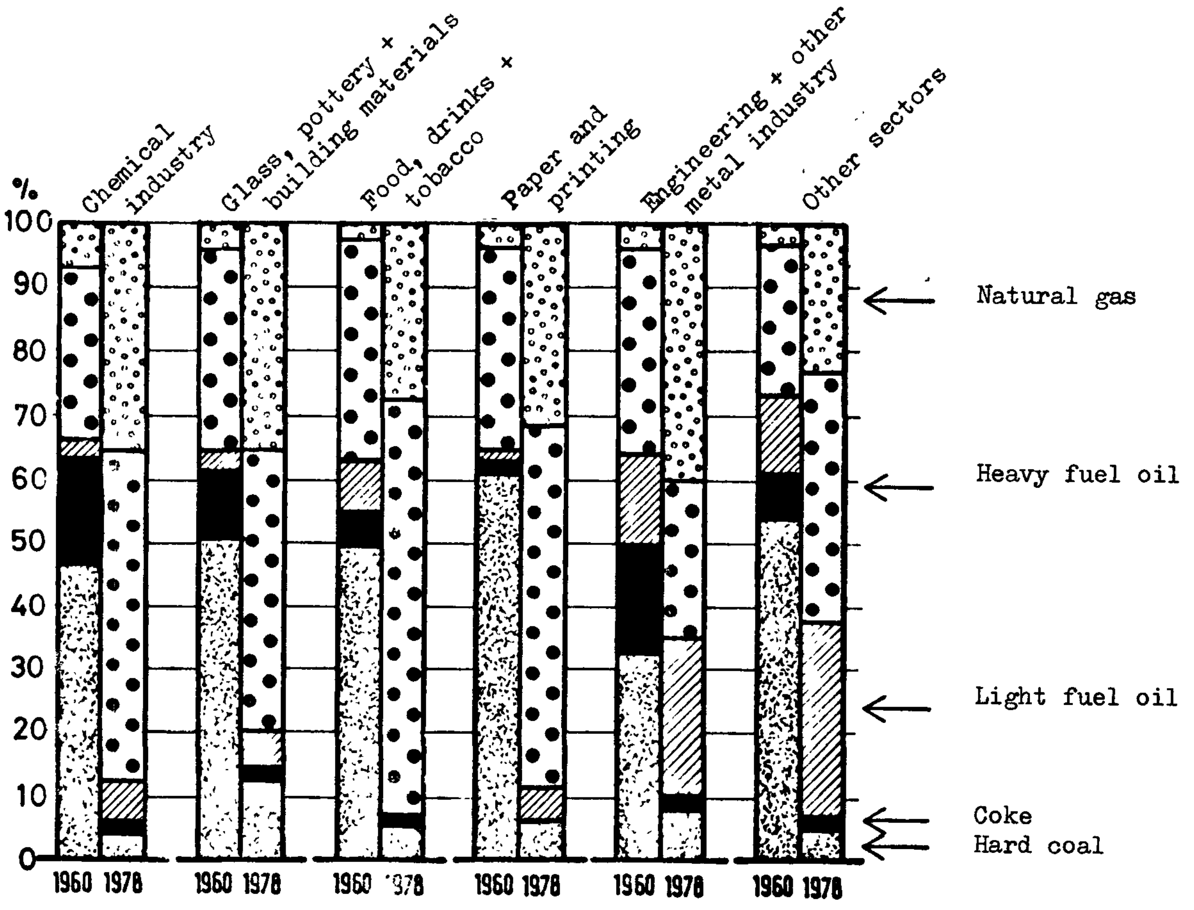
For a wide variety of reasons (discussed in Chapter V) it would be illusory to assume that the quantitative decline in coal consumption could be used as the basis for conclusions about the existing substitution potential or future coal consumption.

13. Looking at the trend in individual branches of industry (Figure B), it can be seen, that although coal's market losses have been considerable in every sector, there are differences; this is because these branches of industry use energy in different ways in accordance with the wide range of production processes

Figure B

Final consumption of selected energies in "other industry" by sectors

(Percentage share of energy sources)



applied. The trend in the chemical industry and in the glass, pottery and building materials sector is particularly important in this respect. These are by far the largest industrial energy-users and it is in these two sectors that the absolute drop in coal sales was the highest.

14. The substitution of other fuels for coal has so far continued unabated in the chemical industry and, at just around 4%, its share of supply in 1978 was lower than in other sectors. Increasing use of natural gas in the seventies has not reduced consumption of heavy oil in this sector, but it has slowed down the rates of increase.

15. The trend in the glass, pottery and building materials sector was basically more favourable for coal. This sector remained the largest user of coal, mainly because of particular importance of cement manufacture during the whole period covered by this report, as there are no particular problems associated with combustion technology or ash utilization in this sector and as coal's price advantage over oil can be realized more quickly. The cement industry is not therefore representative of other industries. As a result, it is the only consumer group in which the use of coal has increased to an appreciable extent since 1975/76 and in which coal accounts for a somewhat larger share of supply (12.4%). However, there are considerable differences here from one country to another. Although large quantities were still used in this sector in France and the Federal Republic in 1960, coal had almost completely disappeared from this sector in 1978 (see Tables 5 and 6 of Annex II).[1] In Belgium and Denmark, on the other hand, coal consumption has even increased since 1960 (see Tables 3 and 4 of Annex II). Although the use of coal in this sector in the Community as a whole increased by 0.8 million toe between 1976 and 1978, most of this was due to the trend in the Belgian cement industry.

16. Coal also continues to register somewhat higher sales in the engineering and other metal sector (1.5 million toe), mainly due to the specific conditions in the United Kingdom. Natural gas and light fuel oil are generally the most important energy sources in this sector; coal substitution has not continued to increase since 1976 and 1978.

17. Of the subsectors selected, food, drink and tobacco and the paper and printing industry today have the lowest coal consumption; they tend to depend on heavy fuel oil more than all other sectors. It is only in the United Kingdom and the Federal Republic of Germany where coal continues to play any role worth mentioning in this sector. Since 1975/76 coal consumption has remained generally static or has increased slightly.

1) Recently, however, there has also been an increase in the coal consumed by the cement industry in these two countries.

18. Finally, it can be seen that, while coal consumption by "other industry" was still relatively evenly spread among the various branches in 1960, by 1978 as much as 40% of it was concentrated on the glass, pottery and building materials sector. Furthermore, there are also considerable differences from country to country; in this connection, the proportion of supply accounted for by coal is unaffected whether the country in question produces (coal's share in Germany : 6%, in the UK: 15%) or imports coal (coal's share in Italy: 1%, in Denmark: 22%).

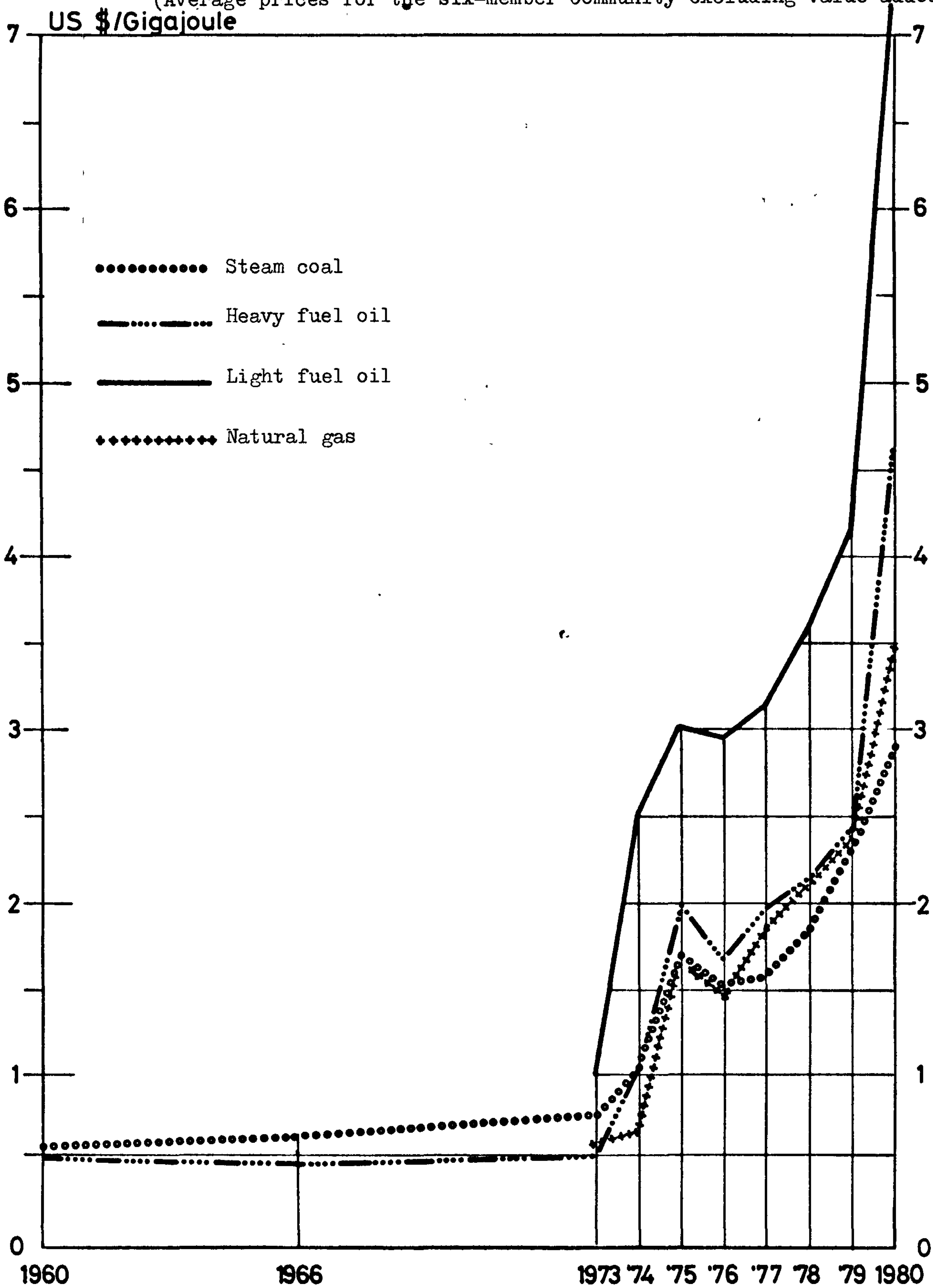
19. There are many reasons why coal's share of the market has fallen (technical handling, high investment expenditure, the problem of ash, environmental regulations, etc.). The most important determinant, however, was the fact that since 1958/1960 the price per unit of heat shifted in favour of rival sources of energy and away from coal (see Figure C).

20. Only information for the six-member Community could be included in Figure C as the period covered starts in 1960. For the purposes of comparison, the calculations since 1973 are not extended to the nine-member Community. The figures given are the average delivered prices weighted according to the quantities used; in the case of coal, only the steam coal prices as a weighted average of Community coal and imported coal are covered.

The figure shows that the price per thermal unit for coal from 1960 to 1973 was always higher than the equivalent price for heavy fuel oil. However, from 1975 onwards the price for coal lay below that for heavy fuel oil and since 1977 the price for coal has been the lowest in comparison with all rival energy sources, including natural gas. One of coal's basic handicaps has therefore been eliminated, at least for large consumers such as power stations, satisfying an important pre-condition for power stations once again using more coal in future. In the case of industry, however, the price ratio for 1980 shown in figure C can not yet be regarded in the main as satisfactory; there can be no self-triggering of a broad-based substitution process in this sector until the heat-price ratio between coal and oil reaches at least 1 : 2.

Figure C

Delivered prices of various energy sources for industrial users
(Average prices for the six-member Community excluding value-added tax)



III. TECHNOLOGY AND THE ENVIRONMENT

A. Technical aspects of the utilisation of energy for thermal purposes.

1. General comments

21. In speaking of industrial energy consumption a distinction is shown between two categories: i) the production of thermal energy, and ii) the production of driving power. Except in the cases of electric furnaces, or heating by electrical means, the heat requirements are met by burning the oil, gas or coal at the point where the energy is actually used. On the other hand, electricity is normally used to provide the driving power for machines. In practice, it is only in covering its heat requirements that industry has any appreciable opportunity to save oil by using coal.

There are no energy consumption statistics broken down into technical categories (e.g. thermal energy, motive power, temperatures, controllability of temperature and cleanness of the combustion gases). The following information is therefore based on empirical data from the Commission's investigations. According to these data, cover of heating requirements is particularly important for the following branches of industry:

- cement, limestone, bricks, tiles, fireclay
- porcelain, glass, earthenware
- paint and enamel drying
- heat bonding methods
- heat treatment in precision engineering
- non-ferrous metals
- chemicals
- oil refineries
- preliminary treatment of textiles and leather
- paper and board
- drying methods
- food, drink and tobacco
- industrial space heating

Not all these branches offer equally good opportunities for the replacemnt of oil by coal. Because of its production techniques, the cement and brick industry is well-suited for conversion. The same cannot be said of other branches of industry where the requirements as regards cleanness and controllability are particularly high.

In addition, the problem of various groups and sizes of coal has to be considered. Coal is not a homogeneous product; the sectors of industrial utilization vary. Some industrial production methods require specific sizes and qualities of coal.

22. When assessing the possibilities of substitution, the various branches of industry can also be distinguished according to the temperatures involved.

- In the low temperature range (up to around 500°C), it is mainly a question of heat utilization whereby the heat is transferred to a conductive material so that the specific fuel characteristics hardly play any part. This sector offers very good opportunities for substitution.
- The medium temperature range (about 500-900°C) mainly covers metal-processing. There are relatively few possibilities of substitution here.
- In the high temperature range (about 900-1600°C), conductive materials are used only in exceptional cases. The materials heated (glass, pottery, building materials) normally come into direct contact with the combustion products. This sector often offers good possibilities for substitution, but some processes have high requirements which coal cannot always satisfy.

2. Coal-fired plant

23. Industry uses different energy-consuming plant which has to correspond to the requirements raised as regards the type and volume of heat production. These plants can use only certain sizes and qualities of coal and any variation has to be kept within strict limits. It would therefore be of importance in the future to have firing plants which could use all sizes and qualities of coal.

A distinction can be made between the following types of plant :

Boilers

The product being heated does not come into contact with the combustion gases, but the selection of the fuel may be significant as the temperatures must be controllable and corrosion problems must be avoided. By means of hot water or steam, boilers provide process heat and/or space heating. Boilers exist in practically all branches of industry.

Retorts

As with boilers, the product being heated does not come into contact with the combustion gases which heat the containers containing the substance to be processed. The choice of fuel is important as corrosion problems must be avoided and appropriate temperatures must be attained and regulated as necessary.

Retorts are mainly used in the following branches of industry:

(a) Chemicals
(b) Oil refineries

Open furnaces

There is direct contact between the product being heated and the combustion gases. The decisive reason for using more coal would be the basic question of whether the process requires precise regulation and high purity of the combustion gases (particularly low sulphur content). This gives two categories:

(a) Special purity and controllability not required:

- cement
- limestone
- bricks, roof-tiles, fireclay
- certain agricultural drying processes, especially for animal feed

(b) Purity and controllability important:

- glass, earthenware, porcelain
- heat treatment in precision engineering
- most heat bonding methods
- paint and enamel drying

Electric furnaces

Electric furnaces require no detailed examination as the metal industry's heat processes which are involved here can hardly be carried out with coal. The electricity is either taken from the public grid or generated in private plant; the latter eventuality comes into the boiler category.

3. Coal combustion technologies

24. There are four main combustion technologies for medium to large coal-fired plants:

- mechanical stoker or chain grate
- pulverized fuel (coal-dust firing)
- fluidized-bed methods
- coal-oil mixtures

The first two methods have been common for decades and will not therefore be discussed further. Although there are disadvantages in using coal instead of oil in these combustion methods (larger dimensions, complicated operation, need to grind the coal, etc.), there is no technical objection to converting a substantial proportion of existing boilers to coal (nuts, slack, dust), especially as these processes will be given further technical improvement and refinement in future.

Fluidized-bed method

25. In this technology, small-sized coal or coal up to 36 mm is fed into the combustion chamber in a bed of coal-ash or silica sand. This bed is kept in suspension by a cushion of air blown through perforations in the chamber floor.

Trials have been conducted for more than ten years with several types of fluidized-bed furnaces and boilers which are now increasingly offered by manufacturers. The advantages of these plants are their compactness, their high combustion intensity and good heat transfer characteristics, the possibility of burning coal of different sizes and qualities and the relatively non-polluting combustion gases; these gases result from the addition of limestone or dolomite to the combustion material in order to prevent discharge of sulphur dioxide. As combustion takes place at medium-range temperatures ($800-900^{\circ}C$), smaller quantities of nitrogen oxides are produced than in the burning of pulverized coal where temperatures of around $1800^{\circ}C$ are not uncommon.

With increasing experience in the construction and operation of fluidized-bed furnaces and boilers, theseadvantages should to an increasing extent influence favourably the choice of plant for small to medium thermal requirements, especially when converting the units from oil firing. The rather complicated and expensive regulating equipment needed for fluidized-bed combustion means that in practice the lowest level for this type of plant is 3 MW and the upper level is around 20 MW; however, fluidized-bed firing will certainly become more economic than conventional firing.

Apart from the fluidized-bed plants under atmospheric pressure, which are now coming on to the market, experiments are being conducted with plants working under pressures of 10-20 bars, especially in Germany, the United Kingdom and the United States. These plants are even more compact and even less harmful to the environment; they also offer a higher efficiency by using the exhaust gases to drive a gas turbine. However, a good deal of development still has to take place.

Coal-oil mixtures

26. The main value of coal-oil mixtures is that they can be transported and burned in existing facilities for heavy fuel oil with a minimum amount of modification.

An attempt is now being made to use centrally-manufactured standard mixtures which are supplied to the consumer by pipeline or road tanker, stored in oil tanks and burned with little or no drop in boiler performance. To achieve these results, a number of valves and burners would have to be replaced, devices installed to trap the fly-ash, and ash blowers and ash hoppers provided. No additional desulphuring plant would be needed if the sulphur content of the coal used remains within certain limits, i.e. is approximately the same as that of the partly replaced fuel oil.

There have, however, been objections about the rapid wear on the burners and the reduced boiler performance. The plants would possess all the characteristics of a coal boiler and a coal-fired plant would therefore be preferable, at least in new installations.

4. Specific branches of industry

27. This section gives a brief description of the main features of a number of selected branches of industry where there could be substantial conversion from oil to coal. Three important pre-conditions have to exist or be created before conversion can take place: cheap coal, optimum modern combustion techniques and low environmental pollution.

Many of the existing plants in the branches of industry described below were originally designed for coal-firing and were only later converted to oil-firing. Technically, this makes re-conversion to coal-firing a relatively simple matter.

On the other hand, boiler plant designed exclusively to use oil has to be replaced by a new boiler if coal is to be used. This is a relatively expensive step as the specific investment costs for oil and coal-fired boilers with the same heating performance are in a ratio of about 1 : 2.5.

28. Many of the branches of industry described, or the larger undertakings, satisfy one basic condition for using coal on a large scale: they are linked to a bulk transport system (rail, waterway).

The size of the undertaking is an additional factor, because the technical problems involved in converting from oil-firing to coal-firing can normally be resolved more effectively in larger plants than in plants where space is restricted. Costs can also be cut with regard to most subsidiary plants and the labour force required for servicing and maintenance.

Cement

29. The technical problems involved in converting the processes of the cement manufacturing industry from oil to coal are relatively simple and are largely restricted to the storage, transport and grinding of coal. In some cases this problem can be resolved by means of grinding contracts with coal-fired power stations or by setting up central coal preparation plants to serve a number of manufacturers' works; in both cases the ground coal can then be delivered to the cement works in special vehicles. A whole range of types of coal can be used, including very cheap coal with a high ash content obtained from spoil tips.

Lime-kilns

30. In this branch too, as in cement manufacture - with which it is often classified under one heading - heating costs play a decisive role in production costs. Coal or coke was traditionally used on a large scale. Many kilns were converted to oil or natural gas to obtain higher-grade products.

Bricks, roof tiles and fireclay

31. In these sectors energy is mainly used for heat treatment in kilns.

The purity of the combustion gases does not matter so much; but better controllability of temperatures means that natural gas has a technical advantage over other fuels.

There are no insurmountable obstacles to the use of coal in many parts of this industry as long as the coal price is attractive enough to outweigh the minor technical disadvantages.

Paper and board

32. Both products are manufactured in practically the same way; wood pulp is used as a raw material.

Wood pulp is obtained either by shredding and pounding the wood - an operation which consumes a good deal of motive energy - or by means of chemical liquifaction ., which requires heat for evaporating surplus liquid. In both cases large quantities of process heat are required for drying the final product.

The need for both process heat and motive power for operating machines - in the case of the mechanical method of treatment - makes it attractive for a company to generate its own electricity as part of a combined power and heat cycle.

B. Environmental problems

33. The increased use of coal leads to the following environmental nuisances:

- noise and dust during carriage, storage and handling
- discharges into the atmosphere during combustion
- ash disposal.

It is even more urgent to find a solution to these problems in those areas with a high population density and a large concentration of industries which also pollute the environment.

34. While some of the environmental problems in every industrial society are general, other aspects are specific to coal. The failure to deal with these disadvantages in the past has led to coal being viewed unfavourably. Almost all these disadvantages can be eliminated by means of appropriate organization and adequate funds. It is a question of cost; the additional expenditure must be offset by the price differential between oil and coal. The tougher the environmental protection regulations are in a given place, the greater must be coal's price advantage to balance the extra expenditure required to satisfy these regulations.

Satisfaction of strict regulations is not necessarily the major environmental problem of those firms wishing to convert from oil to coal. The uncertainty surrounding the interpretation of the legal provisions in this field and expensive, time-consuming and complicated authorization procedures may have a greater deterrent effect than strict environmental regulations.

35. Traditional forms of coal-handling such as storage on open dumps and only partially mechanized and unprotected loading and unloading are labour-intensive and also unattractive activities. Coal dust gets into the air and causes pollution in other places.

In most cases therefore, renewed use of coal instead of oil requires the installation of modern automatic handling plants. This includes enclosed coal stores, e.g. underground, perhaps beneath parking areas, and the enclosed carriage of coal in bunkers either under pressure or on a conveyor belt or by means of a combination of these two methods. The coal falls from the bunker through chutes or is blown into furnaces or boilers by a current of air.

These plants require a little more labour and servicing than in the case of oil. Furthermore, no coal dust escapes and the environment is not therefore polluted.

When handling coal dust, considerations of environmental protection and the explosion risk dictate that the dust must be carried in enclosed vehicles of the tanker type and stored in special bunkers under a protective atmosphere of inert gas. Centralized crushing by the producer or at large-scale users' works could also ease environmental problems and facilitate the supply of small consumers.

36. All combustion also produces gases which are discharged into the atmosphere; when coal, in particular, is burned, more CO_2 is released than in the combustion of oil or natural gas. It is a moot point whether the release of additional carbon dioxide as a result of increased coal-burning will cause damage in the long term; there are, however, no signs of such damage occurring in the short or medium term. It is to be hoped that further research in this field will provide more information.

The discharge of other gases such as compounds of sulphur and nitrogen is not specific to coal, but nitric oxide emissions resulting from the nitrogen content of the fuel are higher than with oil or gas-firing. As stated in the chapter on combustion technologies, some methods even reduce the production or release of such gases. Where necessary, the release of sulphur compounds can be practically avoided by desulphurizing the gas or coal, even though the storage of the residual waste may pose problems.

37. The production of ash is a factor specific to coal; coal-fired plants are therefore connected with appropriate ash collection plants.

Ridding coal-users - especially small-scale users - of the ash problem is one important aspect of the question of replacing oil by coal.

Filters have to be installed to prevent ash components from escaping through the chimney into the environment.

38. Ash in any form may contain harmful substances. If toxins are present in potentially dangerous quantities, special disposals procedures must be used.

39. The solution of the ash problem depends on the possibilities of utilization whereby it is important to distinguish between two types of ash:

- clinker ash
- powder ash.

40. Grate-firing mainly produces clinker. This clinker can be utilized and is widely used as construction materials, road-building materials or, for instance, for land reclamation in the United Kingdom. If the clinker cannot be used, it can only be dumped on to tips (which must subsequently be planted) or used to fill hollows (in this case it is subject to compulsory recultivation).

As a result, the occurrence of even large amounts of clinker should not constitute an insoluble problem if coal consumption by the "other industry" sector happens to increase sharply in future. This is also a problem of organization. Some coal consumers will be able to tackle the problem of large quantities on their own. A large number of smaller coal-users might raise the need for organizations to examine the best possible commercial use, whereby the coal suppliers could assume the responsibility of collecting the ash and utilizing it or dumping it on a centralized basis.

41. Powdered ash is obtained from dust-firing and from filters. It can be up-graded by adding binding agents or may be of value for the cement industry. Carriage and dumping require special dust-prevention measures.

IV. INFRASTRUCTURE PROBLEMS

A. The coal trade

42. The consumer obtains coal either directly from the producer or importer or via wholesalers and retailers.

There are no trading problems involved in the direct supply from producers or importers, even if deliveries were to increase sharply in future. There should be no problems in future in connection with the wholesale trade, provided that it sells directly to the purchaser without intermediate storage. However, problems could arise in the case of wholesalers with their own stores and of retailers. The following argument applies to these two types of trader. Defining their problems is made more difficult by the fact that no recent statistics are available concerning the commercial channels serving the "other industry" sector and the amounts supplied. The traders themselves do not only have industry as their clients; they also have small-scale users, households, public administrations, etc.; i.e. their problems do not arise solely in the field of industrial supply. A general upturn in the coal trade would be of advantage to all consumers.

43. In previous decades, coal traders have dealt almost exclusively in solid fuels. As coal sales have dropped since 1958/1959 they have either gone out of business[1)] or diversified into fuel oil, building materials, fertilizers, etc. Coal often accounts for only 15-20% of total sales.

Any return to coal-trading activities which may prove necessary in future should not mean that activities built up in the past twenty years should be abandoned or scaled down; instead, the trader's overall activities should be extended.

It is doubtful whether existing firms will always be able to expand or whether new firms will be set up. The establishment of new firms appears possible as

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1) Two-thirds of the firms existing in the Federal Republic in 1958 had closed down by 1979.

the coal trade is an attractive commercial activity. The use of modern equipment, the avoidance of laborious and dirty work and advantageous credit facilities on the part of producers, importers and wholesalers wishing to increase sales could provide added incentives.

44. The traditional activities of the coal trade such as advice to customers, "bulking" of orders, purchasing, carriage, storage, treatment of the coal to improve quality, i.e. weighing, mixing, breaking, sifting and, possibly, putting into sacks or other packaging, and, finally, distribution to consumers and possibly, ash recovery (see point 40 above) can, with one exception, be accounted for more or less by means of initiatives and investment; the exception is the space needed for the storage and handling of coal. When the tonnage sold is increased, there must be quicker loading and unloading (change of operating arrangement, increased storage at producers' and importers' premises) or new areas or, possibly, intermediate stores must be set up alongside railway lines or at seaports and inland ports. Many railway companies in the Community still have unused land and shunting yards which could sometimes be converted into modern coal distribution depots, including facilities for the automatic unloading of railway wagons, automatic storage, sorting and loading of lorries.

The considerable increase in coal consumption expected in the Community in future may lead to new problems associated with the mixing of different sizes and qualities of coal to supply the qualities required by the consumer. This is particularly true of imported coal; importers may have to mix sizes and qualities of coal from various origins to obtain the right mix for use.

B. Coal transport

45. One basic condition for using more coal instead of oil is a suitable supply (transport) system. This system is in existence for coal supply as a whole or for the economy as a whole; it will not be possible to give priority to coal supplies for the "other industry" sector. There is therefore no point in considering the amounts carried for the "other industry" sector in isolation, especially as no serious transport problems will arise up to the year 2000, even if the volume were to multiply, as the amounts used by the "other industry" sector are relatively small. Future problems - which take time to solve, although we have up to the year 2000 - could arise because of the interdependence

of transport systems and of the increased coal demand from power stations. The quantities involved could increase by 150-200 million t in the Community by the year 2000.[1].

46. Decisive factors in connection with transport and any difficulties which may arise are the number of users, their geographical position in relation to the internal and imported sources of supply and the extent and rate of the quantitative increases in consumption. These criteria are complicated as they vary from country to country and from region to region; in addition, the future trend cannot yet be assessed with regard to the sites to which the major coal-users will move. In addition to the economic factors, technical and environmental aspects aslo play a role here.

One important aspect for the Community is that supply will be restructured if total coal consumption were to double by the year 2000.[1] Even with a certain increase in internal production total coal imports would have to rise by more than 200 million t. The increase in production mainly affects railways and inland navigation, and imports affect shipping and the seaports and, subsequently, also railways and the inland waterway system, unless new large power stations are built mainly in coastal areas.

47. Those Members of the Community which produce coal should be in a better position to solve the transport problems than those countries which merely consume coal; but the coal-producers too have scaled down coal transport capacity in response to the lower volume or converted it to other merchandise or to passenger traffic. Even if the capacity of transport equipment is expanded relatively quickly - and also substantially - by means of investment, there would be the question of the extent to which this would be possible in respect of the transport infrastructure (road, rail, river, canal).

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[1] See doc. COM(80) 117 final

48. Some problems could arise if the transport volume were to saturate, e.g., the main traffic arteries, while transport capacity is still available on other routes for the supply of small and geographically scattered industrial undertakings.

In addition, there would be the problem of investment if new transport routes had to be created. In view of the time required for building new routes, long-term planning would be needed to ensure that the routes are available when transport demand arises.

49. For these reasons, this study cannot provide detailed information about countries or regions. The following information deals only with general aspects of the various modes of transport.

50. Road transport

As in the case of other bulk goods, the transport of coal on public highways can play no more than a limited role because of economic considerations; the varying regulations in the Member States restrict the useful load of trucks to between 32½ and 50 tonnes. Road transport also raises environmental and traffic problems.

In most cases, the limits for the economic transportation of coal by road in the Community are a maximum distance of around 100 km and quantities of up to 10 000 tonnes a year, although over shorter distances road transport can prove to be the appropriate form of transport for far larger amounts. Road transport mainly comes into consideration for the regional distribution of coal from pits, ports or intermediate stores.

51. Rail transport

According to the statistics available for 1977, almost half (some 100 million t) of the solid fuels consumed in the six original Member States (211 million tce) were carried by rail. About 90% of the volume of solid fuel transported was accounted for by purely domestic transaction, while 10% was accounted for by international traffic forming part of intra-Community trade (mainly German coal and coke).

In 1977 the railways in all nine Member States registered 177 400 million net tonne kilometres in freight traffic. Assuming that about half [1] the increase in coal consumption - i.e. 125 million of the 250 million t - will have to be carried by rail in future (up to the year 2000), this figure would rise by 25 000 million net tonne kilometres.[2] This means an increase of around 15% on the total amount carried in 1977 (see above).

This appears feasible when looking at rail transport as a whole, but it does not get to the heart of the problem of the rail transport of coal, as by the year 2000 the quantity carried would be more than double that carried in 1977. New railway lines would have to be built in some regions of the Community where new large-scale users of coal could establish themselves.

The wagon fleet and wagon capacity must also be increased and modernized. Locomotives are needed. By extending installations, the net load per train could be increased from the current maximum of 1650 t to 2 800 t.

52. Inland waterways

Inland waterways in the Community exist mainly in the Netherlands, Belgium, France and the Federal Republic.

According to the statistics available for 1977, around 15% (32 million t) of the solid fuels used in EUR-6 were carried by inland waterway; about 50% of this traffic was accounted for by cross-frontier traffic between Community countries.

Inland waterways in the nine Member States registered some 100 000 million net tonne kilometres in freight traffic in 1977. Assuming that about 20%[3] of the increase in coal consumption - i.e. some 50 million t [4] of the 250 million t - will have to be carried by inland waterways in future (up to the year 2000), the figure would rise by some 15 000 million net tonne kilometres (15%)[5]. This appears feasible where the general capacity utilization of the inland waterways is concerned, but the special loading and unloading facilities for coal in the inland ports will have to be more than doubled. The vessels too will have to be increased in number, equipped specifically for coal and modernized.

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1) This assumption does not take account of the future competitive situation between railways and inland waterways.

2) With an average distance travelled of 200 km.

3) The percentage was increased from 15% (1977) to 20% as more imported coal will have to be transported from the ports of import in future. This assumption does not take account of the future competitive situation between railways and inland waterways.

4) The transport volume of 1977 (32 million t) would rise by 150%.

5) With an average distance travelled of 300 km.

53. Unloading facilities at seaports

The main acitivity here in future will be to increase capacity and expand the ports to accomodate large coal freighters with a capacity of up to 165 000 t. Problems of space for storing and mixing the coal and the administrative provisions which exist in some of the Community countries could obstruct the increase in capacity.

Some 1 100 million t of merchandise were unloaded at seaports in the nine Member States in 1977. If the Community's current coal imports from non-member countries (about 74 million t in 1980) were to increase by around 200 million t by the year 2000, the total unloading capacity of Community seaports would have to be increased by 20%; where coal is concerned, the unloading facilities must be quadrupled.

54. Maritime transport

As shipping is not exclusively a Community field but an international market, it will not be discussed here.

55. Coastal shipping and pipelines

The carriage of coal by coastal shipping should have some chance of expanding in future were the extension of ports for large freighters not to prove useful and economic in all regions, with the result that the coal had to be transhipped to coastal ships in deep-sea ports.

The carriage of coal by pipeline - mixed with either water or oil - will probably come to account for only a small proportion of total transport volume in the Community. Experts believe that a coal pipeline does not offer economic advantages over other transport systems unless coal is transported in large quantities over long distances (more than 50 km) and no major infrastructure costs are incurred. In general the Community has a well-developed transport network (rail, road, waterway).

C. Conclusions

56. The above information about transport problems shows that the issue is extremely complicated, as data are incomplete even for the present situation and it is impossible to predict where coal-users will establish themselves in future in relation to the Community's coal-producers or the ports importing coal. Any breakdown into individual means of transport of the total additional transport volume resulting from the increase in coal consumption can be no more than arbitrary; all carriers and consumers will have to cooperate on this point in the future.

V. THE FUTURE TREND IN DEMAND

57. It is not the main aim of this study to consider the future quantitative coal consumption potential of the "other industry" sector in the Community. The following information should serve merely as an indication, since many organizations, authorities, etc.,[1] - and also the Commission [2] - have dealt with future trends in world and Community coal consumption in special publications. Some figures dealing with the consumption of the "other industry" sector in the Community in the year 2000 and taken from the publications mentioned are contained in the two tables of Annex III.

58. From the methodical viewpoint, there can be no adequate mathematical scenarios for drawing up quantitative estimates of the future coal requirements of the "other industry" sector. The methods used for the estimates are general, the figures are "guesstimates"and often the coal requirements of "other industry" are calculated as a residual figure without using any special method. It would certainly not be rational to take the ground lost by coal in the "other industry" sector over the past twenty years and assume that the former level will be attained over the next twenty years. Not only has the market for coal changed in the past, but it will continue to change in future in line with conditions of supply on the world energy market. The industrial production apparatus, the technical production methods and the range of products have also changed and will continue to change. When substituting other fuels for oil, industry will often be faced by the decision of whether to convert to coal or, if available, gas. Natural gas will probably remain a strong long-term rival of coal because of its obvious advantages. Coal gasification, which will gain in importance in the nineties, is a possibility to consider in this connection. However, coal requirements in this sector cannot be estimated with sufficient reliability.

[1] IEA/OECD, UN Economic Commission, MIT (WOCOL), CEPCEO, et al.

[2] See doc. COM(80) 117 final

59. This and the technical and economic problems outlined in Chapters III and IV of this study automatically lead to considerable differences in the forecasts. Nevertheless, it can be seen that the potential for increasing coal consumption in industry is generally considered high.

The figures contained in the tables of Annex III lead to two important findings. Table 1 shows that the later forecasts predict higher consumption figures than do the previously-published studies. This is because, as yet, all the possibilities have not been examined and because now it is expected that conversion to coal-firing will be more rapid than previously assumed. The second finding, contained in Table 2, is that the highest absolute increases in coal consumption in the "other industry" sector are expected in those Member States in which coal still played a considerable role in the mid-seventies.

60. It is by no means certain that the conversions from oil to coal expected in this sector in the long term will take place as the continuous development of a process already initiated. In the final analysis, substitution takes place as a result of individual business decisions which are taken only in the presence of important basic conditions such as adequate heat-price differential, a coal combustion technology satisfying the demands of the particular production process in question and minimal environmental pollution. Conversion to coal is already well advanced in the cement industry as all these basic conditions have been met; this is not, however, the case in most other branches of industry.

Rapid continuation of the substitution process often fails as industrial energy-consumers hesitate to convert to even technically advanced coal-fired plant because of their general lack of experience in using solid fuels. Another inhibiting factor is the age structure of the existing oil and gas-fired boilers - a large proportion of this plant will not reach its normal life of 20-30 years until the nineties.

The delaying factors indicated will probably mean that the substitution process will, for the time being, continue only in a number of particularly energy-intensive industrial sectors and then normally with little dynamism of its own. As long as entrepreneurs fail to consider the probability of considérable changes in the heat-price ratio when planning investment, or underestimate the hazards of energy supply, the individual decisions to convert may not reach the proportions desired by energy policy until the nineties. In these circumstances, the replacement of oil by coal in "other industry" will not take place more quickly and on a broader base until special measures are taken to change the external conditions facing potential investors.

CHAPTER VI

General information on investment costs

61. A number of general indications about the investment costs involved in replacing oil are to be given here in the final chapter as information additional to the previously mentioned technical and quantitative problems. The following comments apply only to industry - the infrastructure sectors dealt with previously are not included here as there is virtually no information available on their investment requirements.

This reference to industry's investment costs should give some impression of the amount of capital required for the substitution process. The availability of capital, irrespective of whether it is borrowed or not, is not a decisive point, but it is an important factor in a firm's decision to replace fuel oil with coal.

62. When determining the amount of capital investment needed, firms will also of course calculate the expected profitability of the investment; this depends on a large number of factors and cannot therefore be discussed here. However, the Commission has information from industry, showing that the problem of the pay-back period is an important criterion when deciding whether or not to invest. Although this problem too can be solved only on a case-by-case basis, some general comments are made below in point 67.

63. The measures to be taken when replacing oil vary depending on country, sector of industry and firm; the prices of the capital goods also vary. However, the following general statements may be made:

- Most of the total investment is accounted for by the boiler equipment.
- Coal-fired boilers require considerably higher investment expenditure than oil or gas-fired boilers.

The reason for the latter fact is that coal-fired boilers must be of greater dimensions than oil-fired boilers if they are to achieve the same performance and that additional devices have to be installed for such things as grinding equipment, flue gas desulphurization and the ash disposal. In extreme cases, the resulting investment costs for coal-fired boilers may be 50%-250% **higher** than the corresponding investment costs for oil-fired boilers; the price differential between oil-fired and coal-fired boilers is estimated roughly at 1 : 2.

64. Apart from the relative investment costs for coal-fired boilers, the absolute investment expenditure for substitution is also important; this varies according to whether it is a case of:

- reconversion;
- conversion, or:
- a completely new installation

Reconversion is for oil-fired boilers which used to be operated with coal and are now to be reconverted to burn coal.

Conversion is the adjustment of any installations which were designed as oil-fired boilers and which are to be converted to coal.

In addition to these criteria, investment costs are not proportional to the size of the boiler - the investment costs per unit of boiler performance drops as boiler size increases. The fact that the conversion of smaller boilers requires relatively higher investment costs than for larger boilers runs counter to the future substitution trend.

65. When the above criteria are applied to a large-scale industrial power plant

- with a capacity of 750 mW;
- operated for 6 000 hours a year;
- and consuming one million tonnes of fuel oil a year (or 1.5 m tonnes of coal),

the following investment costs may be expected (as a general indication) :

	Specific investment expenditure	Total investment expenditure	Investment expenditure per tonne of fuel oil replaced
	ECU/kW	m ECU	ECU
Reconversion	100	75	75
Conversion	250	190	190
New construction	500	375	375

The investment costs involved in replacing one tonne of fuel oil thus depend to a very large extent on the form this replacemnt takes.

66. The amount of capital per tonne of fuel oil needed for converting a large plant is relatively low compared with small plants. Although dealing with individual cases and thus of only limited significance for gauging the overall situation, certain information suggeststhat investment expenditure per tonne of fuel oil replaced can be expected to total

150-300 ECU for reconversion
300-500 ECU for conversion

in plants with an annual coal throughput of some 50 000 - 100 000 t (35 000 - 70 000 t of fuel oil).

The capital required by small industrial plants for each million tonne of fuel oil to be replaced by coal therefore amounts to several hundred million ECU.

67. During the Commission's investigations, industry pointed out that the replacement of fuel oil by coal is subject to a large number of imponderables which make firms adopt a wait-and-see attitude before reaching a decision about replacement. The imponderables consist not only of general risks which must normally be taken into account with any investment, but arise specifically in the case of replacement, since the future trend in the price relation between fuel oil and coal is fraught with problems of energy policy, oil price policy and exchange rates, etc., which can hardly be predicted-and thus the

pay-back period representing the ratio between capital investment and cost saving - are determined by the trend in this price differential. In view of these risks, firms seek to make the pay-back period as short as possible, i.e. some two to three years.

It should also be considered that the pay-back period for the invested capital depends not only on the relative price differential between fuel oil and coal but also from the utilization of boiler capacity. If the boiler is operated for 6 000 hours a year and the fuel throughput is correspondingly high, the total cost-saving is also high and, compared with the capital investment, results in a relatively shorter pay-back period than in cases where the same boiler is used for only 2 000 hours a year, which often happens in smaller plants. The smaller industrial plants are in a worse position than large plants in this respect.

As far as experience is available and calculations can be made, the pay-back period in smaller plants amounts to some 5-6 years or longer; decisions on replacement are oftern delayed for that reason. If coal's price advantage over fuel oil should increase in future or if the capital investment could be reduced or made cheaper by means of aid measures, the wait-and-see attitude which may at present be observed could be overcome.

ANNEX I

List of the individual criteria influencing the decision to replace oil by coal in individual industrial undertakings

1. When coming to a decision about converting firing plant from oil to coal, undertakings in the "other industry" sector face two types of problem :

   (i) general data extraneous to the undertaking
   (ii) technical and financial conditions within the undertaking itself.

2. General data extraneous to the undertaking

   The following aspects can be mentioned by way of example :

   - the general state of development of coal-firing methods (rational, convenient, clean, environmentally acceptable, etc.)
   - problems associated with obtaining coal (network of dealers and distributors, availability of imports of Community coal, transport)
   - ash disposal or ash utilization
   - assessment of the supply risks for oil and coal
   - future trends in the differential of the price per thermal unit between oil, imported coal, Community coal, lignite, gas, electricity, etc.
   - other means for replacing oil not by coal but by other energy sources (lignite, gas, electricity, etc.)
   - local environmental protection regulations and the accompanying official authorization procedures
   - development of environmental legislation
   - how competitors are dealing with the question of plant conversion

- general economic prospects

- prospects on the market in the specific products manufactured by the undertaking.

Technical and financial conditions within the undertaking itself

(a) Technical conditions

- height and dimensions of boilerhouses, boilers, firing plant, chimneys, etc.

- storage space at the factory, bunkers - underground, above ground

- transport from store or bunker to firing plant
- access and exit routes on factory premises

- technical requirements of the production process (purity, uniformity, controllability, flame temperature)

(b) Financial conditions

1. Financial advantage

There is only one advantage : the differential in the price per thermal unit. From the probable differential in the price per thermal unit which works to coal's advantage must be subtracted the effect due to the - possibly - lower degree of efficiency. The efficiency rating covers not only the boiler but also the individual requirements of operational preparedness for production purposes (is the flame needed continually or only intermittently ?).

2. Financial disadvantages

- Raising the amount of investment needed for conversion (including land for stores, etc.). This is either a problem of acquiring capital, if outside funds are required for finance (particularly important in the case of small and medium-sized firms which do not have access to the stock market), or a problem of liquidity (in the case of self-financing).

- interest payments and repayment conditions for investments conducted by means of outside finance

- depreciation, consisting of two categories :

  -- extraordinary depreciation on the old dismantled firing plant
  -- normal depreciation on the newly-installed plant

- labour costs, expenditure on materials and repairs involved in the operation of converted plant

- dangers or financial consequences of interruptions in production due to conversion (may be mitigated by temporary use of auxiliary units or by production for stocks).

4. Conclusion

The aspects mentioned in points 2 and 3 must be weighed up by the investor and then assessed.

It is by no means certain that this overall assessment will be based exclusively on quantifiable financial considerations in individual cases. The financial aspect will certainly be a supporting factor in the decision-making. However, this factor must be weighted if it is considered in connection with the risks associated with the supply of oil and the security of supply in the case of coal.

ANNEX II.

(Table 1)

Total Final Energy Consumption in "Other Industry"

(Self producers of electricity excluded)

(in 1 000 t.o.e)

		Hard coal, coke fuel oil (light and heavy) natural gas	Other fuels	Sub-total	Electricity	TOTAL
Belgique	1960 1970 1978	3 913 6 652 6 235	494 468 344	4 407 7 120 6 579	1 763 3 129 4 098	6 170 10 249 10 677
Danmark	1960 1970 1978	992 3 291 2 402	105 232 255	1 097 3 523 2 657	385 769 1 113	1 482 4 292 3 770
Deutschland (BR)	1960 1970 1978	19 570 32 613 31 606	6 303 3 830 2 615	25 873 36 443 34 221	15 266 22 482 28 181	41 139 58 925 62 402
France	1960 1970 1978	14 817 27 012 24 444	1 200 1 027 1 572	16 017 28 039 26 016	8 606 13 793 16 839	24 623 41 832 42 855
Ireland	1960 1970 1978	682 1 248 1 317	- 63 123	682 1 311 1 440	175 427 730	857 1 738 2 170
Italia	1960 1970 1978	10 136 22 940 21 538	320 2 289 642	10 456 25 229 22 180	6 413 12 441 15 110	16 869 37 670 37 290
Luxembourg	1960 1970 1978	59 138 151	3 26 26	62 164 177	52 107 266	114 271 443
Nederland	1960 1970 1978	3 658 7 269 8 252	585 460 297	4 243 7 729 8 549	1 713 3 736 5 710	5 956 11 465 14 259
United Kingdom	1960 1970 1978	28 699 31 199 27 194	2 835 2 731 1 659	31 534 33 930 28 853	10 675 18 828 19 471	42 209 52 758 48 324
Community	1960 1970 1978	82 526 132 362 123 139	11 845 11 126 7 533	94 371 143 488 130 672	45 048 75 712 91 518	139 419 219 200 222 190

ANNEX II

(Table 2)

COMMUNITY

Final Consumption of Selected Energies in "Other Industry"

(Self producers of electricity excluded)

(in 10^3 t.o.e.)

Industry		Coal	Coke	Light fuel oil	Heavy fuel oil	Natural gas	TOTAL
Chemical industry	1960	7 271	2 712	425	4 217	1 079	15 704
	1970	4 066	1 317	2 289	13 315	6 910	27 897
	1976	1 228	759	2 156	14 620	10 316	29 109
	1978	1 125	662	1 742	14 964	10 302	28 795
	1978*	1 578	23	107	3 403	2 075	7 186
Glass, pottery, building materials	1960	9 766	2 104	645	6 135	707	19 357
	1970	3 887	1 386	3 174	18 371	5 375	32 193
	1976	2 717	497	1 871	13 169	9 730	28 004
	1978	3 470	364	1 848	12 342	9 872	27 896
	1978*	2	-	-	10	11	23
Food, drink and tobacco	1960	5 367	532	908	3 771	246	10 824
	1970	2 284	294	2 905	9 020	1 541	16 044
	1976	808	192	1 945	8 157	3 617	14 719
	1978	855	187	1 895	7 938	4 217	15 132
	1978*	94	4	3	311	169	586
Paper and printing	1960	3 918	134	99	2 034	241	6 426
	1970	2 057	83	529	5 823	922	9 414
	1976	366	5	442	4 930	2 045	7 838
	1978	531	4	424	4 800	2 682	8 441
	1978*	550	9	13	1 118	357	2 047
Engineering and other metals	1960	3 652	1 831	1 622	3 522	476	11 103
	1970	1 852	1 374	6 427	7 269	2 688	19 610
	1976	1 398	639	4 790	4 976	6 546	18 349
	1978	1 474	454	4 606	4 801	7 488	18 823
	1978*	127	6	11	272	149	565
Others	1960	10 302	1 380	2 274	4 512	644	19 112
	1970	2 932	1 057	8 926	12 466	1 823	27 204
	1976	1 331	667	7 050	10 163	5 942	25 153
	1978	1 196	514	7 265	9 422	5 655	24 052
	1978*	789	7	12	1 441	455	2 704
TOTAL	1960	40 276	8 693	5 973	24 191	3 393	82 526
	1970	17 078	5 511	24 250	66 264	19 259	132 362
	1976	7 848	2 759	18 254	56 035	38 226	123 172
	1978	8 651	2 185	17 770	54 317	40 216	123 139
	1978*	3 140	49	151	6 555	3 216	13 111

* Self producers of electricity

N.B. Figures may differ from the total of those for Member States listed in tables 3 to 11 due to conversion from t.c.e. to t.o.e.

ANNEX II

(Table 3)

BELGIQUE/BELGIE

Final Consumption of Selected Energies in "Other Industry"

(Self producers of electricity excluded)

(in 10^3 t.o.e)

Industry		Coal	Coke	Light fuel oil	Heavy fuel oil	Natural gas	TOTAL
Chemical industry	1960	161	110	40	330	-	641
	1970	2	90	112	909	293	1 406
	1976	8	50	66	643	838	1 605
	1978	20	29	70	380	738	1 237
	1978*	-	-	-	27	106	133
Glass, pottery, building materials	1960	307	80	82	306	-	775
	1970	320	97	318	1 199	287	2 221
	1976	422	32	187	433	997	2 071
	1978	935	22	196	453	875	2 481
	1978*	-	-	-	-	-	-
Food, drink, and tobacco	1960	172	22	73	222	-	489
	1970	32	13	159	341	6	551
	1976	8	6	109	230	117	520
	1978	3	7	114	294	67	485
	1978*	-	-	-	22	3	25
Paper and printing	1960	125	-	15	98	-	238
	1970	14	34	52	198	2	300
	1976	-	-	18	122	57	197
	1978	-	-	19	129	64	212
	1978*	-	-	-	20	11	31
Engineering and other metals	1960	68	22	85	145	-	320
	1970	16	164	186	298	69	733
	1976	14	44	120	187	151	516
	1978	6	22	126	197	137	488
	1978*	-	-	-	8	-	8
Others	1960	509	176	222	543	-	1 450
	1970	57	66	531	630	157	1 441
	1976	9	52	308	451	231	1 051
	1978	7	41	322	752	210	1 332
	1978*	-	-	-	32	82	114
TOTAL	1960	1 342	410	517	1 644	-	3 913
	1970	441	464	1 358	3 575	814	6 652
	1976	461	184	808	2 116	2 391	5 960
	1978	971	121	847	2 205	2 091	6 235
	1978*	-	-	-	109	202	311

* Self producers of electricity

ANNEX II

(Table 4)

DANMARK

Final Consumption of Selected Energies in "Other Industry"

(Self producers of electricty excluded)

(in 10^3 t.o.e.)

Industry		Coal	Coke	Light fuel oil	Heavy fuel oil	Natural gas	TOTAL
Chemical industry	1960	-	1	14	56	-	71
	1970	-	1	70	145	-	216
	1976	1	-	43	111	-	155
	1978	3	-	49	111	-	163
	1978*	-	-	-	-	-	-
Glass, pottery, building materials	1960	170	14	18	194	-	396
	1970	149	19	69	759	-	996
	1976	280	14	55	385	-	734
	1978	338	12	62	381	-	843
	1978*	-	-	-	-	-	-
Food, drink and tobacco	1960	5	1	18	212	-	236
	1970	7	3	68	822	-	900
	1976	21	4	54	417	-	496
	1978	49	3	61	413	-	526
	1978*	-	-	-	-	-	-
Paper and printing	1960	-	-	4	47	-	51
	1970	-	-	12	183	-	195
	1976	42	-	9	93	-	144
	1978	77	-	11	92	-	180
	1978*	-	-	-	-	-	-
Engineering and other metals	1960	-	1	21	45	-	67
	1970	-	1	82	176	-	259
	1976	-	2	66	89	-	157
	1978	-	1	73	87	-	161
	1978*	-	-	-	-	-	-
Others	1960	-	1	124	46	-	171
	1970	4	1	463	257	-	725
	1976	1	-	385	92	-	478
	1978	3	-	434	92	-	529
	1978*	-	-	-	70	-	70
TOTAL	1960	175	18	199	600	-	992
	1970	160	25	764	2 342	-	3 291
	1976	345	20	612	1 187	-	2 164
	1978	520	16	690	1 176	-	2 402
	1978*	-	-	-	70	-	70

* Self producers of electricity

ANNEX II

(Table 5)

DEUTSCHLAND (B.R.)

Final Consumption of Selected Energies in "Other Industry"

(Self producers of electricity excluded)

Industry	Year	Coal	Coke	Light fuel oil	Heavy fuel oil	Natural gas	TOTAL
Chemical industry	1960	1 813	1 137	93	932	108	4 033
	1970	969	558	477	3 461	2 324	7 789
	1976	900	305	440	3 802	2 641	8 038
	1978	780	336	431	4 104	3 421	9 072
	1978*	1 166	-	1	594	694	2 455
Glass, pottery, building materials	1960	3 214	1 298	168	1 157	-	5 837
	1970	509	692	1 315	4 281	1 738	8 535
	1976	231	280	816	3 266	2 179	6 772
	1978	284	197	795	3 070	2 343	6 689
	1978*	2	-	-	10	8	20
Food, drink and tobacco	1960	1 303	182	144	616	-	2 245
	1970	535	69	792	1 737	218	3 351
	1976	214	47	861	1 935	524	3 581
	1978	210	50	821	1 917	633	3 631
	1978*	24	-	-	110	101	235
Paper and printing	1960	878	61	19	380	-	1 338
	1970	324	9	235	1 481	164	2 213
	1976	131	2	226	1 331	407	2 097
	1978	183	1	198	1 379	593	2 354
	1978*	92	-	-	545	162	799
Engineering and other metals	1960	787	587	402	649	-	2 425
	1970	413	245	2 100	1 322	1 133	5 213
	1976	213	112	1 979	1 040	1 347	4 691
	1978	198	108	1 771	1 024	1 670	4 771
	1978*	78	-	1	192	132	403
Others	1960	2 064	483	284	762	49	3 642
	1970	708	522	1 443	2 124	715	5 512
	1976	325	329	1 369	1 790	2 599	6 412
	1978	269	231	1 399	1 305	1 885	5 089
	1978*	38	-	-	107	136	281
TOTAL	1960	10 059	3 743	1 110	4 496	157	19 570
	1970	3 453	2 095	6 362	14 406	6 292	32 613
	1976	2 014	1 075	5 691	13 164	9 697	31 641
	1978	1 924	923	5 415	12 799	10 545	31 606
	1978*	1 400	-	2	1 558	1 233	4 193

* Self producers of electricity

ANNEX II
(Table 6)
FRANCE

Final Consumption of Selected Energies in "Other Industry"

(Self producers of electricity excluded)

(in 10^3 t.o.e)

Industry	Year	Coal	Coke	Light fuel oil	Heavy fuel oil	Natural gas	TOTAL
Chemical industry	1960	851	257	149	413	339	2 009
	1970	559	317	855	1 666	741	4 138
	1976	292	185	339	2 916	1 106	4 888
	1978	257	177	382	2 985	1 335	5 136
	1978*	24	-	17	273	259	573
Glass, pottery, building materials	1960	1 635	238	272	830	141	3 116
	1970	480	271	1 050	3 305	697	5 803
	1976	120	80	413	3 617	1 457	5 687
	1978	91	48	424	3 640	1 496	5 699
	1978*	-	-	-	-	-	-
Food, drink and tobacco	1960	1 199	103	561	411	7	2 281
	1970	305	67	1 540	1 853	70	3 835
	1976	56	50	403	2 303	225	3 042
	1978	80	66	397	2 371	304	3 218
	1978*	3	-	-	80	-	83
Paper and printing	1960	740	1	33	353	85	1 212
	1970	274	-	140	861	191	1 466
	1976	38	-	82	1 122	194	1 436
	1978	50	-	81	1 145	238	1 514
	1978*	7	-	-	246	10	263
Engineering and other metals	1960	470	362	753	317	24	1 926
	1970	209	313	3 010	817	260	4 609
	1976	87	66	1 337	777	896	3 153
	1978	100	50	1 325	707	1 236	3 418
	1978*	-	-	-	-	-	-
Others	1960	2 079	363	1 056	748	27	4 273
	1970	947	340	3 695	2 036	93	7 161
	1976	453	199	2 565	1 790	436	5 493
	1978	393	185	2 500	1 782	599	5 459
	1978*	14	-	2	101	22	139
TOTAL	1960	6 974	1 324	2 824	3 072	623	14 817
	1970	2 774	1 308	10 290	10 538	2 052	27 012
	1976	1 016	590	5 194	12 525	4 354	23 699
	1978	971	526	5 109	12 630	5 208	24 444
	1978*	48	-	19	700	291	1 058

* Self producers of electricity

ANNEX II
(Table 7)
IRELAND

Final Consumption of Selected Energies in "Other Industry"
(Self producers of electricity excluded)

(in 10^3 t.o.e.)

Industry	Year	Coal	Coke	Light fuel oil	Heavy fuel oil	Natural gas	TOTAL
Chemical industry	1960	Breakdown by sectors not available; all figures included in "others"					
	1970						
	1976						
	1978						
	1978*						
Glass, pottery, building materials	1960						
	1970						
	1976						
	1978						
	1978*						
Food, drink, and tobacco	1960						
	1970						
	1976						
	1978						
	1978*						
Paper and printing	1960						
	1970						
	1976						
	1978						
	1978*						
Engineering and other metals	1960						
	1970						
	1976						
	1978						
	1978*						
Others	1960	462	7	49	164	-	682
	1970	104	7	156	981	-	1 248
	1976	21	7	177	953	-	1 158
	1978	25	7	367	918	-	1 317
	1978*	-	-	-	49	-	49
TOTAL	1960	462	7	49	164	-	682
	1970	104	7	156	981	-	1 248
	1976	21	7	177	953	-	1 158
	1978	25	7	367	918	-	1 317
	1978*	-	-	-	49	-	49

* Self producers of electricity

ANNEX II
(Table 8)
ITALIA

Final Consumption of Selected Energies in "Other Industry"

(Self producers of electricity excluded) (in 10^3 t.o.e.)

Industry		Coal	Coke	Light fuel oil	Heavy fuel oil	Natural gas	TOTAL
Chemical industry	1960	186	198	3	1 110	631	2 128
	1970	87	146	453	4 769	858	6 313
	1976	13	83	36	4 916	1 576	6 624
	1978	10	56	31	4 653	1 366	6 116
	1978*	-	-	4	1 493	187	1 684
Glass, pottery, building materials	1960	680	171	5	2 169	566	3 591
	1970	131	145	40	6 050	1 823	8 169
	1976	58	31	106	4 292	3 104	7 591
	1978	84	21	98	3 666	3 049	6 909
	1978*	-	-	-	-	-	-
Food, drink and tobacco	1960	11	24	3	850	238	1 126
	1970	4	34	12	1 450	355	1 855
	1976	1	45	70	1 250	701	2 067
	1978	1	35	59	1 019	724	1 838
	1978*	-	-	-	34	36	70
Paper and printing	1960	4	-	3	390	157	554
	1970	-	-	10	1 350	221	1 581
	1976	-	-	19	1 153	398	1 560
	1978	-	-	17	930	516	1 463
	1978*	-	-	-	286	126	412
Engineering and other metals	1960	31	64	25	630	452	1 202
	1970	9	218	68	1 600	493	2 378
	1976	6	279	235	1 046	1 303	2 874
	1978	7	140	215	913	1 078	2 353
	1978*	-	-	-	54	15	69
Others	1960	68	27	2	904	534	1 535
	1970	28	16	9	2 121	450	2 621
	1976	52	66	170	2 299	753	3 345
	1978	59	35	151	1 901	710	2 859
	1978*	15	-	-	1 009	110	1 134
TOTAL	1960	980	484	41	6 053	2 578	10 136
	1970	259	559	592	17 340	4 190	22 940
	1976	130	504	636	14 956	7 835	24 061
	1978	161	287	571	13 035	7 434	21 538
	1978*	15	-	4	2 876	474	3 369

*Self producers of electricity

ANNEX II

(Table 9)

LUXEMBOURG

Final Consumption of Selected Energies in "Other Industry"

(Self producers of electricity excluded)

(in 10^3 t.o.e.)

Industry		Coal	Coke	Light fuel oil	Heavy fuel oil	Natural gas	TOTAL
Chemical industry	1960	-	-	3	8	-	11
	1970	-	-	34	29	-	63
	1976	-	-	-	46	-	46
	1978	-	-	14	38	-	52
	1978*	-	-	-	-	-	-
Glass, pottery building materials	1960	13	1	5	3	-	22
	1970	-	-	19	11	-	30
	1976	-	-	14	1	-	15
	1978	-	-	-	-	-	-
	1978*	-	-	-	-	-	-
Food, drink and tobacco	1960						
	1970						
	1976						
	1978						
	1978*						
Paper and printing	1960	Breakdown by sectors not available; all figures included in "others"					
	1970						
	1976						
	1978						
	1978*						
Engineering and other metals	1960						
	1970						
	1976						
	1978						
	1978*						
Others	1960	12	3	4	7	-	26
	1970	14	1	16	14	-	45
	1976	-	1	18	15	17	51
	1978	-	1	21	72	5	99
	1978*	-	-	-	-	-	-
TOTAL	1960	25	4	12	18	-	59
	1970	14	1	69	54	-	138
	1976	-	1	32	62	17	112
	1978	-	1	35	110	5	151
	1978*	-	-	-	-	-	-

*Self producers of electricity

ANNEX II
(Table 10)

NEDERLAND

Final Consumption of Selected Energies in "Other Industry"

(Self producers of electricity excluded)

(in 10^3 t.o.e.)

Industry	Year	Coal	Coke	Light fuel oil	Heavy fuel oil	Natural gas	TOTAL
Chemical industry	1960	136	123	33	530	-	822
	1970	22	95	14	584	2 188	2 903
	1976	15	100	1 021	309	2 685	4 130
	1978	36	12	591	690	2 175	3 504
	1978*	35	-	-	80	608	723
Glass, pottery, building materials	1960	216	13	19	216	-	464
	1970	92	1	7	340	650	1 090
	1976	7	15	12	106	794	934
	1978	3	16	22	124	829	994
	1978*	-	-	-	-	-	-
Food, drink and tobacco	1960	222	25	19	691	-	957
	1970	1	11	30	692	822	1 556
	1976	-	15	34	172	1 129	1 350
	1978	-	-	38	173	1 367	1 578
	1978*	7	-	-	30	27	64
Paper and printing	1960	226	-	4	207	-	437
	1970	-	-	12	329	333	674
	1976	-	-	2	30	284	316
	1978	-	-	4	39	532	575
	1978*	14	-	-	20	48	82
Engineering and other metals	1960	39	43	56	162	-	300
	1970	2	19	93	208	270	592
	1976	1	20	50	44	442	557
	1978	-	13	117	55	736	921
	1978*	-	-	-	-	-	-
Others	1960	240	6	42	355	35	678
	1970	29	1	74	407	303	814
	1976	7	-	26	71	283	387
	1978	1	-	44	92	543	680
	1978*	23	-	-	31	104	158
TOTAL	1960	1 079	210	173	2 161	35	3 658
	1970	146	127	230	2 560	4 566	7 629
	1976	30	150	1 145	732	5 617	7 674
	1978	40	41	816	1 173	6 182	8 252
	1978*	79	-	-	161	787	1 027

*Self producers of electricity

ANNEX II

(Table 11)

UNITED KINGDOM

Final Consumption of Selected Energies in "Other Industry"

(Self producers of electricity excluded)

(in 10^3 t.o.e.)

Industry		Coal	Coke	Light fuel oil	Heavy fuel oil	Natural gas	TOTAL
Chemical	1960	4 124	887	91	839	-	5 941
	1970	2 427	110	274	1 722	506	5 039
	1976	1	36	154	1 877	1 499	3 567
	1978	20	52	175	2 003	1 267	3 517
	1978*	353	23	85	936	220	1 617
Glass, pottery building materials	1960	3 531	290	77	1 259	-	5 157
	1970	2 207	161	357	2 426	179	5 330
	1976	1 599	45	268	1 090	1 199	4 201
	1978	1 685	47	252	1 008	1 289	4 281
	1978*	-	-	-	-	3	3
Food, drink and tobacco	1960	2 455	175	91	769	-	3 490
	1970	1 397	97	305	2 123	70	3 992
	1976	508	26	410	1 801	921	3 666
	1978	513	26	396	1 800	1 122	3 857
	1978*	61	3	8	36	2	110
Paper and printing	1960	1 945	71	21	559	-	2 596
	1970	1 445	40	60	1 422	11	2 987
	1976	156	3	86	1 129	715	2 039
	1978	220	3	94	1 085	739	2 142
	1978*	437	9	13	-	-	459
Engineering and other metal	1960	2 257	752	280	1 573	-	4 862
	1970	1 203	415	889	2 848	474	5 829
	1976	1 076	116	1 002	1 794	2 413	6 401
	1978	1 162	120	980	1 818	2 631	6 711
	1978*	48	6	10	18	2	84
Others	1960	4 868	316	489	980	-	6 653
	1970	1 043	102	2 537	4 234	106	8 022
	1976	462	12	2 039	2 702	1 570	6 785
	1978	440	14	2 025	2 503	1 704	6 686
	1978*	699	7	10	41	2	759
TOTAL	1960	19 180	2 491	1 049	5 979	-	23 699
	1970	9 722	925	4 431	14 775	1 346	31 199
	1976	3 802	238	3 959	10 393	8 317	26 709
	1978	4 040	262	3 922	10 218	8 752	27 194
	1978*	1 598	48	126	1 031	229	3 032

*Self producers of electricity

ANNEX III

Table 1

Summary of Various Forecasts of Coal Consumption in "Other Industry"

COMMUNITY

Mtoe

	Base Year	1990	2000
Steam Coal 2000 (1)	1976 10.8	21.3	37.2
CEPCEO (2)	1976 11.9	..	70.0-105.0
WOCOL (3)	1977 13.6	24.5-41.8	42.2-78.9
Doc. COM (80) 117 final (4)	1980 14.5	30.0	35.0
ECE Questionnaire (5)	1978 44.9	65.7-67.3	..

(1) IEA/OECD: Steam Coal Prospects to 2000, Paris 1978, figures of Annex 1, table 1-1 under "other coal". In addition to Other Industry, these figures include Households and Transport. The Commission has deducted the latter two from the base year and adjusted the forecasts by assuming a further drop in household consumption.

(2) Association of the Coal Producers of the European Community: Report on Prospects of Coal Consumption in the Other Industry Sector of the Community Energy Market, Brussels 1979.

(3) Coal - Bridge to the Future, Report of the World Coal Study (WOCOL), Cambridge Massachusetts, USA 1980, pages 226 ff. Figures for Belgium, Luxembourg and Ireland are Commission estimates.

(4) Commission of the European Communities: Outlook for the Long-Term Coal Supply and Demand Trend in the Community, Doc. COM (80) 117 final, 18.3.1980.

(5) Replies by Governments of Member States to ECE Questionnaire 1979. These figures are not strictly comparable as, subject to certain adjustments, they include consumption by the steel industry.

ANNEX III

Table 2

Forecasts of Coal Consumption in "Other Industry"

WOCOL 1980 Mtoe

	1977	1990	2000
Belgique (1)	0.7	2.0 - 2.4	2.7 - 3.4
Danmark	0.5	0.5 - 0.8	0.5 - 1.0
Deutschland	3.5	4.2 - 6.3	5.6 - 8.4
France	2.1	4.9 - 13.3	9.8 - 28.0
Ireland (1)	0.1	0.1 - 0.2	0.2 - 0.3
Italia	0.2	1.4	1.7 - 2.1
Luxembourg (1)	-	-	-
Nederland	0.2	1.6 - 2.0	2.1 - 2.8
United Kingdom	6.3	9.8 - 15.4	19.6 - 32.9
Community	13.6	24.5 - 41.8	42.2 - 78.9

(1) Estimates by the Commission - not shown in WOCOL Study