

COMMISSION OF THE EUROPEAN COMMUNITIES

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**PROPOSAL FOR A COUNCIL DIRECTIVE
AMENDING DIRECTIVE 88/609/EEC ON THE LIMITATION OF EMISSIONS
OF CERTAIN POLLUTANTS INTO THE AIR FROM LARGE COMBUSTION PLANTS**

COMMISSION REPORT

ON

THE AVAILABILITY OF COAL WITH A LOW SULPHUR CONTENT

(presented by the Commission)

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SUMMARY

This proposal for a Directive amends Directive 88/609/EEC on the limitation of emissions of certain pollutants into the air from large combustion plants. The limit values for emissions of sulphur dioxide from new plants using solid fuel, as given in Annex III, are supplemented to include values for plants of between 50 and 100 MWth.

The emission limit value of 2 000 mg/m³ is based on the use of a LSC fuel without any additional control measures.

Explanatory memorandum

Directive 88/609/EEC on the limitation of emissions of certain pollutants into the air from large combustion plants did not set limit values for SO₂ for new plants of between 50 and 100 MWth which use solid fuel.

However, it did require a subsequent Commission proposal on such plants together with a report on the availability of low-sulphur solid fuel (LSC).

The report is attached to this explanatory memorandum.

The report put forward a limit of 1.5 g per kcal for the sulphur content of LSC coal. Emissions from the combustion of this type of coal can be limited to 2 000 mg/m³ without any additional controls.

Total annual production of LSC coal in the Community is around 35 million tonnes.

However, the location of production sites, mainly in the United Kingdom and France, makes it difficult for the industries where boilers of this capacity mainly operate to use this type of fuel.

To meet their LSC coal needs, these industries will have to turn to the international market on which many countries (Australia, Colombia, Indonesia, China, etc.) sell their production. Of the 200 million tonnes of coal placed on the market and intended for combustion plants, 80% has a sulphur content of less than 1% by weight, i.e. 1.5 g per kcal. This could easily cover the Community's import requirements, which total around 90 million tonnes a year.

By way of comparison, an estimated 3 to 5 million tonnes of coal a year are needed by plants with a capacity of between 50 and 100 MW.

This coal is available more cheaply than that produced in the Community since transport costs are offset by much lower production costs.

However, account must still be taken of constraints (quotas applied by certain Member States) which artificially increase the price of imported coal or which restrict the amount which may be imported.

The main conclusion which the Commission has drawn from the report is that sufficient amounts of LSC coal are available at an acceptable price.

Moreover, the limited demand for LSC coal from industries using boilers of this capacity means that the impact on national production in the Member States will be minimal.

The Commission therefore considers that a limit value of 2 000 mg/m³ for new plants of this capacity can be observed by using the appropriate fuel, without any additional control measures.

Nonetheless, there would not appear to be any justification at present for dropping below this limit of 2 000 mg/m³.

Current combustion gas purification techniques are costly for plants of this size, and less expensive combustion techniques (fluidized bed combustion) have yet to be developed for this category of capacity.

The Commission therefore considers that it would be inappropriate to drop below the 2 000 mg/m³ value for plants of between 50 and 100 MWth.

Accordingly, it has put this value in the proposal, pending a reexamination of its position as part of the general review of limit values for new plants. This review is required under Directive 88/609/EEC and must take place before July 1995.

**PROPOSAL FOR A COUNCIL DIRECTIVE
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POLLUTANTS INTO THE AIR FROM LARGE COMBUSTION PLANTS**

THE COUNCIL OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Economic Community, and in particular Article 130s thereof,

Having regard to the proposal from the Commission,¹

Having regard to the opinion of the European Parliament,²

Having regard to the opinion of the Economic and Social Committee,³

Whereas the 1973,⁴ 1977,⁵ 1983⁶ and 1987⁷ European Community action programmes on the environment stress the importance of the reduction and prevention of atmospheric pollution;

Whereas in their resolution concerning the action programme on the environment 1987 to 1992 the Council and the Representatives of the Governments of the Member States meeting within the Council emphasized that Community action should concentrate, *inter alia*, on the application of appropriate standards in order to ensure a high level of public health and environmental protection;

Whereas Directive 88/609/EEC on the limitation of emissions of certain pollutants into the air from large combustion plants did not set limit values for SO₂ for new plants of between 50 and 100 MWth which use solid fuel;

Whereas Annex III to Directive 88/609/EEC states that the Council, on the basis of a report from the Commission, shall set emission limit values for new plants of between 50 and 100 MWth which use solid fuel;

Whereas, according to the Commission's report to the Council on the availability of low-sulphur fuel, the difficult situation which had delayed the setting of these limit values has now improved, thanks notably to the availability on the world market of sufficient quantities of coal with a low sulphur content;

Whereas emissions from the combustion of this type of coal can be limited to 2 000 mg/m³;

Whereas, in view of the damage caused to the environment by atmospheric pollution, the emission limit values for plants of between 50 and 100 MWth should be set at this level,

HAS ADOPTED THIS DIRECTIVE:

1 OJ No

2 OJ No

3 OJ No

4 OJ No C 112, 20.12.1973, p. 1.

5 OJ No C 139, 13.06.1977, p. 1.

6 OJ No C 46, 17.02.1983, p. 1.

7 OJ No C 328, 07.02.1987, p. 1.

Article 1

Directive 88/609/EEC is hereby amended as follows:

The following paragraph is added to Article 4(1):

- 1a. Annex III, containing the emission limit values for sulphur dioxide for new combustion plants which use solid fuel, shall be supplemented to include a limit value of of 2 000 mg SO₂/m³ for plants with a rated thermal input of between 50 and 100 MWth.

Article 2

1. Member States shall bring into force the laws, regulations and administrative provisions required to comply with this Directive by 30 June 1993 at the latest. They shall immediately inform the Commission thereof.
2. When Member States adopt these provisions, these shall contain a reference to this Directive or shall be accompanied by such reference at the time of their official publication. The procedure for such reference shall be adopted by Member States.
3. Member States shall communicate to the Commission the texts of the provisions of national law which they adopt in the field covered by this Directive.

Article 3

This Directive is addressed to the Member States.

Done at Brussels,

For the Council
The President

COMMISSION REPORT

ON

**THE AVAILABILITY OF COAL WITH A LOW
SULPHUR CONTENT**

**COMMISSION REPORT:
ON
THE AVAILABILITY OF COAL WITH A LOW SULPHUR CONTENT**

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**COMMISSION REPORT
ON THE
AVAILABILITY OF COAL WITH A LOW SULPHUR CONTENT**

1. INTRODUCTION

The Council, at its meeting of 24th November 1988, adopted the Directive 88/609/EEC concerning the limitation of emissions of certain pollutants into the air from large combustion plants⁽¹⁾. In its annexe III, the directive stipulates that: " In 1990, from a Commission report on the availability of fuel (coal) with low sulphur content and a pertinent proposal of the Commission, the Council will decide on the limit values for emissions from plants between 50 and 100 MW".

With this in mind, the following report is aimed at satisfying the Council's requirement by means of a presentation of a wide compendium on the availability of low-sulphur coal both inside the Community and in the international coal market.

2. GENERAL ASSESSMENT

2.1 Methods of controlling sulphur emissions

Sulphur emissions arise from the oxidation process during combustion of the sulphur contained in coal and other fuels. There are several types of action available to control sulphur emissions, which can be implemented at the different stages of the combustion process. Any one of these actions can be taken or, indeed, a combination of two or more during the combustion cycle. For example, there is the choice of the appropriate input fuel, choices in the actual process of combustion by use of the appropriate combustion technology and, finally, a choice in the emissions by means of purifying the gases.

Basically, the main choices are the following:

- Use of low sulphur content.
- Sorbent addition (ie: Fluidised Bed Combustion) and injection processes.
- Flue gas desulphurisation.

Obviously, depending on the technology used for burning the coal, and/or the actions adopted to deal with the gas emissions, the quality of the coal in relation to the sulphur content can vary substantially from one installation to another. In other words, under the same SO₂ emission limits, the coal that is suitable for one installation may be unsuitable for another.

Therefore whilst in some cases the coal quality required will be exclusively low sulphur, in others coal with a medium sulphur content could be suitable, which can be achieved either directly by a specific type of coal or by blending coals from different sources and with a differing sulphur content. Finally, some installations will be able to use coals with a medium and, in certain cases, a high sulphur content.

(1) OJ L 336 07.12.88 p.1.

2.2 Definition of low sulphur coal

Although a proportion of sulphur may be retained in the ash (usually 5-10%, although this may be higher in some low rank fuels) there is a direct relationship between sulphur content and SO₂ emissions. For example, using standard conversion factors without allowing for sulphur capture in the ash, uncontrolled SO₂ emissions from a 1% sulphur coal would be around 2000 mg/m³. These figures assume a flue gas volume of some 1.5 m³ per 1000 kilocalories (thermie) at 0°C, 101,3 kPa, 6% oxygen.

Those coals able to meet uncontrolled SO₂ emissions lower than 2000 mg/m³ will therefore be considered as having a low sulphur content for this report. This emission standard will lead to a coal type with a ratio of sulphur content, in grammes, to thermie of heat content of some 1.5.

Given the remit of this report, the attention will be focussed exclusively on the first option mentioned above, in particular to the availability of coal with a low sulphur content on the market both from within the Community and from the third countries which are the main suppliers of the international coal trade market.

2.3 Coal cleaning

Coal cleaning techniques were largely pioneered in Europe in the first half of the century. There was intensive research and development in France, Germany, the Netherlands and the UK. This effort was, however, adversely affected by the availability of cheap oil in the 1950s and 1960s. In comparison the USA which, until recent years, had for decades been the main coal exporter, coal was regarded as a cheap fuel and not thought to justify much effort to increase its value.

The intended use for the coal, the price of competitive coals and the cost of transport will all influence the requirement for preparation/cleaning. Sometimes it is simply the ash quantity that is important but, in other situations, the removal of the sulphur before the coal is used is the most important factor.

Due to the widespread use of coal in industrial and electric utility boilers, the existence of competitive fuels, and the growing restrictions on emissions, there is an increasing need to reconsider the economic limits of both ash and sulphur removal. Coal users are placing more constraints on the quality of the coal they use both to improve the efficiency of their operations by reducing costs and also to meet statutory emissions limits.

The key factors affecting the use of low sulphur coal in emission control, therefore, are its availability and cost relative to the other controls available.

Coal is a heterogeneous material which is contaminated by a wide variety of impurities. These affect its properties and consequently its potential for utilisation. The presence of troublesome impurities, principally ash-forming minerals and sulphur, detracts from its value for combustion. Some mineral impurities are interspersed throughout the structure of the coal seams, some arise from the mining operation itself, and others (such as organic sulphur, nitrogen and some mineral salts) are an integral part of the organic structure.

Sulphur can therefore occur in coal in three main forms, as follows:

- organic sulphur, where it is incorporated into the hydrocarbon compounds of the coal structure;
- sulphide minerals in the inorganic fraction (pyritic sulphur);
- sulphate minerals in the inorganic fraction (sulphate sulphur).

Conventional coal cleaning can remove on average between 10 and 50% of the total coal sulphur

content, but there are exceptions. By the use of cleaning, and other preparation methods, physical coal properties can be modified, mainly as a result of the partial removal of impurities such as ash and sulphur. However, this implies a greater degree of manipulation and some loss both in the weight and in the final energy balance of the coal and also to an increase of the specific heat content, by unit of weight, of cleaned coal.

Most of remaining sulphur will probably be in an organic form which remains bound within the coal itself throughout the physical cleaning process. Chemical and biological methods for removing this organic sulphur are being developed but are not likely to be commercially available for many years.

In practice most industrial coals in the Community are either totally or partially washed and only limited scope exists for further reducing sulphur content by this method.

3. THE AVAILABILITY OF COAL WITH A LOW SULPHUR CONTENT.

When investigating the availability of coal, then obviously both domestic, and imported, coal must be considered.

Currently imported hard coal covers some 40% of the total Community hard coal demand in terms of total deliveries (320 million tonnes). Moreover, this share is expected to increase in the coming years as indigenous Community hard coal production is anticipated to decrease as a result of the restructuring programmes currently being carried out by the Member States and the increasing demand for coal that is coming largely from the electricity generating sector.

3.1. Availability of indigenous hard coal with a low sulphur content within the Community

Four Member States of the Community produce significant quantities of hard coal: the United Kingdom, Germany, Spain and France. Belgium is likely to see its last mine close by the end of current year, whilst Portugal, Ireland and Italy produce only marginal tonnages.

Total Community production is estimated to have been 193.5 Mt in 1991, of which around 76% is of thermal quality, whilst the remainder of Community production is of coking quality. Of this Community production, some 139 million tonnes (or 72% of the total) is coal used by public power stations.

| MEMBER STATE | PRODUCTION | IMPORTS | DELIV. POWER STATIONS | DELIV. INDUSTRY* |
|--------------|--------------|--------------|-----------------------|------------------|
| Belgium | 0.6 | 12.6 | 5.7 | 1.0 |
| Denmark | -- | 13.5 | 12.3 | 0.5 |
| Germany | 72.6 | 9.5 | 45.4 | 7.7 |
| Spain | 18.9 | 10.6 | 22.7 | 2.6 |
| France | 9.8 | 20.2 | 10.5 | 4 |
| Greece | -- | 1.5 | 0.1 | 1.3 |
| Ireland | 0.0 | 2.7 | 2.0 | 0.4 |
| Italy | 0.0 | 18.9 | 9.4 | 1.3 |
| Luxemburg | -- | 0.2 | -- | 0.2 |
| Netherlands | -- | 15.7 | 9.0 | 2.0 |
| Portugal | 0.3 | 4.1 | 3.4 | 0.8 |
| Utd. Kingdom | 91.2 | 19.5 | 85.0 | 7.5 |
| Total | 193.5 | 129.0 | 205.5 | 29.3 |

* Other deliveries than those to the steel-industry and to the cokerics.

However, for indigenous hard coal, there are huge differences between the coal qualities (heat content, sulphur content, etc).

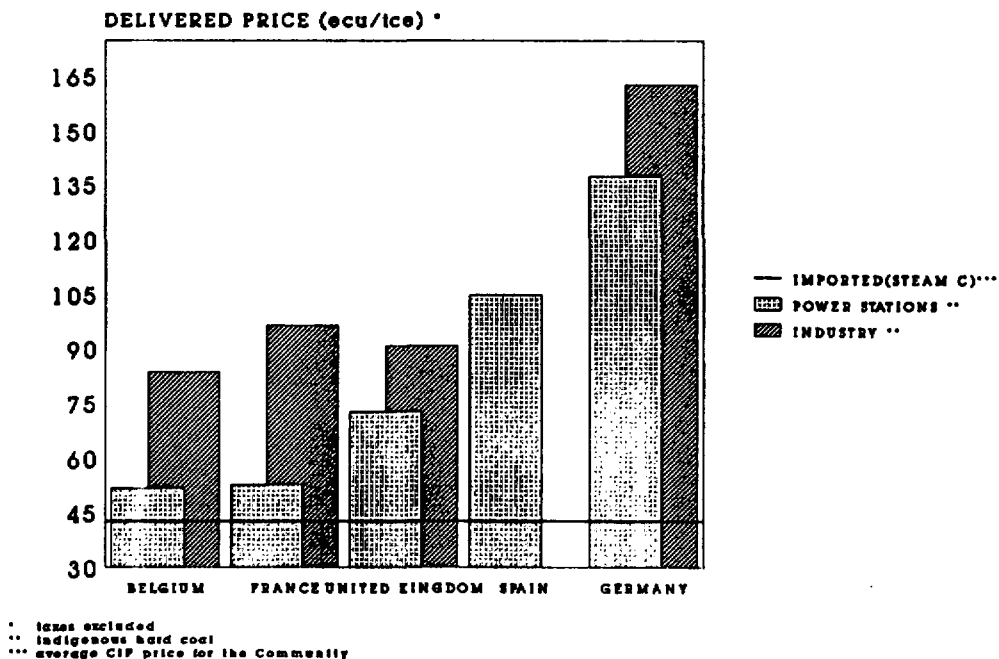
Although there is a large production of lignite in the Community, mainly in Germany, Greece, Spain and to a much lesser extent Ireland, France and Italy, this type of coal has not been considered due to its high sulphur content in relation to the calorific content.

The existing technology for burners in furnaces of a power range of between 50-100 MW allows not only classified coals but also unclassified coals in a wide range particle-size range.

With respect to prices, there are huge differences both between the prices practised by the different Member States for the indigenous coal produced and also between domestic coal and coal from third countries. An example of prices for deliveries to power stations and to the industrial consumer, both for indigenous coal and for coal from third countries, is given below. In the case of Germany, prices for deliveries to power stations include the aid under the Third Electricity Law.

As regards prices for industrial coals, one should bear in mind that producers apply important discounts with respect to the list prices for the industrial coals, which are not included in the graph below. The size of these discounts for the indigenous coal depend on the degree of protection with respect to external suppliers; in other words the availability of coal from third countries, the infrastructure, the inland distances and transport, etc. In many cases the final price for indigenous industrial coal is not much higher than that for imported coal.

DELIVERED PRICES FOR HARD COAL TO POWER STATIONS AND INDUSTRIAL CONSUMERS *



As can be seen, there is a clear price advantage for coal coming from third countries. The difference in prices for indigenous coal deliveries are the result of the higher production costs of the Community coal industry although there are substantial differences between Member States. Some of the differences are also the result of the mechanism of indirect aid, via prices or consumption, to the coal industry.

3.1.1. United Kingdom

The United Kingdom is the largest hard coal producer in the European Community with a total output of some 91.2 million tonnes in 1991. It also has the lowest average production costs of the Community because of the efforts carried out to make the coal industry competitive. Of its total production some 85% goes to power stations and some 8% to industry. Other markets such as coke ovens, patent fuel, householders, etc., account for the remaining 7% of production.

Despite the large production, coal quality is relatively homogeneous. This is particularly true of the sulphur content. Average sulphur content is estimated to be around 1.5-1.6% in weight for a calorific value of slightly more than 5800 kcal/kg; ie: 2.6-2.8 g of sulphur per net thermie. This sulphur content will lead to average SO₂ emissions of some 3500 mg/m³.

In the following table some reference qualities, sulphur content, heat content and estimated prices for industrial thermal coals, excluding those classified coals with a screening size above of 50*0 mm are given for the different coalfields.

| TABLE II. CHARACTERISTICS OF BRITISH HARD COAL (INDUSTRIAL COALS) | | | | |
|--|--|------------------------|--|---|
| COALFIELD | NET CALORIFIC VALUE (kcal/kg) | SULPHUR (%) | SULPHUR PER THERMIE (g) | ESTIMATED PRICE (ECU/tce)* |
| Scottish | 5980-5751 | 0.6-0.9 | 1.0-1.5 | 92-100 |
| | 5436-5715 | 0.95-1.6 | 1.75-2.8 | 92 |
| North East | 6566 | 1.0 | 1.52 | 96 |
| | 5800-6434 | 1.3-2.8 | 2.24-4.4 | 86-87 |
| Cumbria | 6439 | 1.93 | 3.0 | 87 |
| Yorkshire | 5336-6313 | 1.4-2.0 | 2.3-3.6 | 87-95 |
| South Yorkshire | 5486-7280 | 1.05-2.2 | 1.9-3.7 | 87-85 |
| Nottinghamshire | 5460-6781 | 1.15-1.9 | 2.1-3.4 | 87-95 |
| North Derbyshire | 5692-6903 | 1.7-2.1 | 2.5-3.6 | 87-95 |
| S. Derbyshire, Leicestershire and Warwickshire | 5183-6400 | 1.4-2.25 | 2.26-4.34 | 86-95 |
| Cannock Chase | 5270-6660 | 0.85-1.6 | 1.3-3.0 | 86-95 |
| Lancashire | 5860-6990 | 1.4-2.0 | 2.0-3.1 | 89-95 |
| N. Staffordshire and Wales | 5720-6580 | 1.0-2.7 | 1.5-4.7 | 76-103 |
| South Wales | 5850-6110 | 0.75-1.05 | 1.26-1.79 | 88 |

* Pithead prices, not including deductions and discounts.

** screening sizes up to some 50*0 mm

Most of the low sulphur coal (less than 1.5 gramme per thermie) in the UK is to be found in Scotland (the Longannet pit and some opencast) and, to a much lesser extent, in South Wales. Both these areas are under great pressure to close because of their relatively high production costs. In addition, the total yearly output from these areas is also fairly small.

With respect to delivery prices to the industry, it must be said that there are usually some price

discounts, to the extent that sometimes prices can come close to those for coal from third countries. However, the delivered final price is dependent on the location where the coal is to be burnt. Indeed, in some cases, there can be a substantial burden on prices due to natural geographical protection (such as the long distances from available ports) and sometimes even the limited infrastructures for importing coal.

3.1.2. Germany

Germany is the second producer of coal in the Community. Total hard coal production accounted for some 72.6 million tonnes in 1991, of which some 55% went to power stations, 28% to the steel industry, whilst the remainder is used by the "other industry", including industrial power stations, and other sectors.

| TABLE III. CHARACTERISTICS OF GERMAN HARD COAL | | | | |
|---|--|--------------------------------------|--------------------|---------------------------------|
| COALFIELD OR PIT | | NET CALORIFIC VALUE (kcal/kg) | SULPHUR (%) | SULPHUR PER THERMIE* (g) |
| Friedr. Heinrich # | | | 0.74-1.24 | 1.07-1.80 |
| Niederberg # | | | 0.80-1.20 | 1.16-1.74 |
| Rheinland | | | 0.89-1.29 | 1.29-1.87 |
| Walsum # | | | 0.86-1.26 | 1.25-1.83 |
| Lohber/Osterfeld | | | 0.79-1.19 | 1.15-1.73 |
| Prosper | | | 1.01-1.31 | 1.46-1.90 |
| Fürst Leopold # | | | 0.90-1.20 | 1.30-1.74 |
| Westerholt # | | | 0.93-1.53 | 1.35-2.22 |
| Consolidation | | | 0.72-1.12 | 1.04-1.62 |
| Hugo | | 6900 | 0.60-1.15 | 0.87-1.67 |
| Ewald/Schl.&Eisen | | | 0.90-1.20 | 1.30-1.74 |
| Gen. Blumenthal # | | | 0.76-1.26 | 1.10-1.83 |
| Min. Achenbach # | | | 0.90-1.60 | 1.30-2.32 |
| Haus Aden | | | 1.10-1.70 | 1.59-2.46 |
| Monopol | | | 0.70-1.65 | 1.01-2.39 |
| Heinrich Robert | | | 0.70-1.20 | 1.01-1.74 |
| SUBTOTAL RAG | | 6900 | 0.60-1.70 | 0.87-2.46 |
| Saarberg coalfield | | 6350 | 0.85-0.99 | 1.34-1.56 |

* Sulphur per thermie for the RAG estimated on the average calorific value.

Mines producing classified coals (5% of the total RAG production or some 3 million tonnes)

The average sulphur content is estimated to be around 1.05%, or some 1.5 gr per thermie. This means that Germany produces around 30 million tonnes of coal per year (of which some 3 million tonnes per year are classified coals) which would be able to meet the SO₂ emission of 2000 mg/m³.

With respect to the prices charged for deliveries to industry, one can classify the customers into two categories. Firstly there are those industries which produce their own electricity and/or heat requirements and, on the other hand, those companies using coal only for heat.

The coal in the first group can be included in the agreement between coal producers and electricity producers, the "Jahrhundertvertrag", where there is a financial compensation and a price mechanism for the sale of German coal to the electricity industry. This is governed by the third "electricity-from-coal" Law.

Prices for coal deliveries for the second group are to be found in the list prices. However, substantial discounts are applied as the industry does have access to imported coal. Discounts are such that the differences in price compared to imported coal are not that large.

3.1.3. Spain

Spain is the third producer of hard coal in the Community. In 1991, some 18.9 million tonnes were produced. Of this, more than 95% was delivered to the power stations whilst the remainder went mainly to the heating market, with the exception of small tonnages which went to industry.

The coal produced has a wide range of sulphur content per thermie, from 0.26 up to 22 g for some small quantities of black lignite.

Hard coal production is estimated to have an average sulphur content just above 2% in weight. The distribution of sulphur by coalfield is as follows:

| <i>TABLE IV. CHARACTERISTICS OF SPANISH HARD COAL</i> | | | |
|---|---------------------------------|-------------|-------------------------|
| COALFIELD | GROSS CALORIFIC VALUE (kcal/kg) | SULPHUR (%) | SULPHUR PER THERMIE (g) |
| Asturias | 3400-7010 | 0.5-2.8 | 1.0-6.0 |
| Leon-Palencia | 3100-6200 | 0.3-3.8 | 0.6-7.0 |
| Sur | 3400-5360 | 0.1-1.2 | 0.2-2.3 |
| Cataluña-Teruel | 2800-4400 | 2.0-7.0 | 5.8-22.0 |

Hard coal production with a sulphur content lower than 1.5 g per thermie is estimated to be around 3.1 million tonnes (2.2 Mtce). However, it is important to point out that almost all the production is under a vertical agreement between electrical producers and coal producers. In addition, the prices that the coal producers receive from their sales to power stations are twice the CIF price for coal coming from third countries.

Thus, due to the vertical agreement and the prices charged, it can be said that the coal producers will give preferential treatment to the power stations. Only small tonnages with a low sulphur content, excluding that consumed by householders and the tertiary sector, could be available in the market provided that they are price competitive with respect to coal from third countries. These small tonnages would have to come either from opencast or from underground pits not covered by the current deals with the power stations.

However, due to the high costs of production, and therefore the high delivered prices for industrial coal, practically all the coal consumed by industry is imported from third countries. In addition, because of national regulations, thermal imported coal from third countries consumed by power stations must not exceed a sulphur content of 1g per thermie.

3.1.4. France

Total hard coal production was 9.75 million tonnes in 1991. The most important coalfield is located in Lorraine whilst a smaller one is situated in the Centre-Midi. Production from opencast accounts for some 13% of the total production.

Of the total thermal coal production, some 6.4 million tonnes were delivered for electricity generation either to the EdF or to the "own power plants" of CdF. Just over 0.6 million tonnes were

delivered to industrial users.

| Deliveries to: | <0.8 | 0.8-1.0 | 1.0-1.5 | >1.5 | Total |
|----------------|-------------|-------------|-------------|-------------|-------------|
| Utilities CdF | 3.16 | 0.58 | 0.38 | - | 4.12 |
| Utilities EdF | 0.37 | 1.80 | 0.09 | - | 2.26 |
| Industry | - | - | 0.53 | 0.13 | 0.66 |
| Total | 3.53 | 2.38 | 1.00 | 0.13 | 7.04 |

* Sulphur content in percentage of weight

With respect to the coal quality, some 5.9 million tonnes of coal with a low sulphur content are produced, mostly in the Lorraine coalfield, and all of it is consumed by the power stations. In the other mines, coal produced has a sulphur content to heat content ratio so high that in normal burning the SO₂ emissions would exceed a concentration of 2000 mgr/m³. In the following table some reference qualities are given for typical mines:

| COALFIELD | NET CALORIFIC VALUE (kcal/kg) | SULPHUR (%) | SULPHUR PER THERMIE (g) |
|--------------------------|-------------------------------------|----------------|----------------------------------|
| Lorrainc (high volatile) | 7160-7245 | 0.95 | 1.3 |
| (low volatile) | 6500-6730 | 1.1-1.2 | 1.6-1.9 |
| Mine de Le Mans | 5850 | 1.3 | 2.1 |
| Mine de Decazeville | 6400-6600 | 1.6-1.7 | 2.4-2.6 |
| Mine de Blanzay | 6735 | 1.3 | 1.9 |

Prices for coal deliveries to industry including discounts are in line with those for coal imported from third countries.

3.1.5. Belgium

In Belgium, the last pit in operation will close by the end of 1992. Total production in 1991 was around 0.6 million tonnes and the average sulphur content estimated to be some 0.95% or 1.6 g per thermie.

3.2. Existing situation with respect to imports of hard coal

Imported coal plays an essential role in meeting the energy requirements of the Community. Total hard coal imports from third countries reached 129 million tonnes in 1991, which represented some 40% of the total amount of coal available on the Community market. Of these imports, around 69% were of thermal coal quality.

When considering imports, a distinction must be drawn between the coal "coming from" and "originating in" since the legal framework could be different.

In principle, Article 71 of ECSC Treaty allows the Governments of the Member States to retain their

powers in matters of commercial policy. National rules therefore remain applicable with regard to direct imports from third countries. However, Member States must afford each other such mutual assistance as is necessary to implement measures recognised by the Commission as being in accordance with the ECSC Treaty and with existing international agreements. Under the provisions of the ECSC Treaty the principle of free movement applies to products in free circulation in Member States.

Intra-Community trade, on the other hand, is in continual decline. This trend is expected to continue in the future and may even be more accentuated. Most of the intra-Community exchanges of indigenous Community coal is in coking coal qualities. On the other hand, there are increasing quantities of thermal hard coal from third countries in free circulation within the Community. With the latter, sales are mainly originating from the Netherlands, Belgium and, recently, from the United Kingdom.

Despite the fact that coal is free to move within the Community, intra-Community trade of indigenous thermal quality hard coal is practically nonexistent because the national arrangements, consumption and pricing systems do not favour such a movement. In addition, the prices that producers are paid for their exports within the Community are largely in line with those from non-Community countries. When taking into account the higher Community production costs (107 ECU/tce in 1991), such trade is simply not profitable with average CIF prices for non-Community steam coal imports of some 42 ECU/tce in 1991.

The existing regulations in the Member states with respect to direct imports of hard coal coming from third countries is the following:

- Belgium:** System of licences "All Licences Granted" (ALG).
- Denmark:** There are no restrictions
- Germany:** Imports of hard coal from third countries are subject to import regulations under the so-called "Kohlen-ZollkontingentGesetz" (Coal Tariff Quota Law), although this regulation has not been extended to the eastern provinces. Together with a import quota of 7.1 million tonnes for all categories of consumers, there is a quota of 12 million tonnes for the electrical sector, which is related to the conditions of the "Jahrhundertvertrag", and another quota of some 12 million tonnes for the market (for the substitution of oil and gas) as well as certain quantities for liquefaction and gasification in the steel industry (which are not currently used). Any tonnages above these limits have a custom duty of 6DM per tonne. These quotas has never been fully used in the past.
- Greece:** There are no restrictions
- Spain:** A system of duty free quotas and licenses which are fixed in advance. The import quota for 1992 was set at 14.2 million tonnes, of which 2.7 million tonnes is for industrial use, other than the steel and electricity generating industries. These quotas have never been fully used in the past. The sulphur limit for coal to be consumed at power stations imported from third countries is currently set at 1g per 1000 kcal heat value.
- France:** System of licences for importation. The import requests are collected by the Ministry of Industry which then fixes the quotas whilst bearing in mind the structure of the domestic market. ATIC, a parastatal organisation, has the monopoly for the whole technical side of imports
- Ireland:** There are no restrictions.

Italy: There are no restrictions.

Luxembourg: There are no restrictions.

Netherlands: System of license ALG.

Portugal: There are no restrictions.

United Kingdom: System of licence ALG

It is very important to highlight that the only Member States using quotas system are those with vertical agreements, ie; Germany and Spain.

3.3. The availability of hard coal with a low sulphur content in the international market.

Internationally coal trade moved around 412 million tonnes in 1991, of which 369 million tonnes were sea-borne. Roughly 45% corresponded to coking coal quality and the rest to other qualities, mainly steam coals. This international trade is expected to increase substantially over the next decade.

The European Community, the largest world importer of coal, absorbs some 35% (129 million tonnes) of the total global annual sea-borne coal, of which some 69% was of thermal coal qualities. However there are substantial differences in relation to quantities and final uses among the Member States which are dependent both on their energy policy and whether or not they have any domestic production. Obviously, those Member states that do not have any indigenous hard coal production satisfy the majority of their total hard coal requirements from the international coal market. This is particularly true for their thermal hard coal requirements, given that there are not many opportunities for intra-Community, thermal, hard coal trade. At the same time, Community hard coal producers are taking increasing quantities from the international market to balance their requirements and to compensate for the gaps left by the restructuring of their own industries.

With respect to the hard coal imports, eight coal exporting countries account for more than 96% of the total Community coal imports. These countries are: the United States, South Africa, Australia, Colombia, Poland, the CIS, Canada and China. Of these, four (the USA, S. Africa, Australia and Colombia) account for 82% of the total coal imports of the Community.

| COUNTRY | PRODUCTION | EXPORTS | | EXPORTS TO EEC | |
|--------------|------------|---------|----------------|----------------|----------------|
| | | TOTAL | STEAM COAL (%) | TOTAL | STEAM COAL (%) |
| USA | 830 | 98 | 39 | 50.6 | 48 |
| South Africa | 171 | 46 | 93 | 25.2 | 98 |
| Australia | 175 | 120 | 46 | 20.1 | 48 |
| Colombia | 23 | 15 | 100 | 10.1 | 99 |
| Poland | 139 | 13 | 62 | 6.1 | 80 |
| CIS | 480 | 25 | 50 | 5.3 | 98 |
| Canada | 40 | 34 | 16 | 3.8 | 79 |
| China | 1086 | 12 | 77 | 3.0 | 100 |

The sulphur content ranges of the coal produced by the main exporting countries vary considerably for particular countries and between different countries. However, in many cases, only a small proportion of the coal produced is designated for export (see table above). That designated for export

is often defined in such a manner that coal qualities, in relation to heat content and sulphur content, are substantially above the average coal qualities produced by these countries.

The range of sulphur content for selected hard coals produced by the main coal exporters is as follows:

| TABLE VIII. TYPICAL RANGE OF SULPHUR CONTENT | |
|---|----------------------------|
| COUNTRY | SULPHUR CONTENT (%) |
| USA | 0.2-4.8 |
| South Africa | 0.6-1.6 |
| Australia | 0.2-4.0 |
| Colombia | 0.4-0.9 |
| Poland | 0.4-2.2 |
| CIS | 0.5-3.1 |
| Canada | 0.4-2.5 |
| China | 0.3-2.9 |
| Indonesia | 0.08-1.0 |

By contrast, around 80% of the thermal coal internationally traded has a sulphur content below 1%, with over 10% having less than a 0.7% sulphur content. Low sulphur traded coals are supplied by Australia, Colombia, Canada, South Africa and Indonesia. Only the United States trades large volumes of coal that has a sulphur content above 1%.

Most of the thermal coals imported by the Community have a sulphur content below 1% and only a marginal proportion of imports surpasses this limit.

To give a rough idea of the average sulphur content of sea-borne traded steam coals, the following table gives an estimation of tonnages for 1991 and the forecast for 2000, together with the average net calorific content, for the main world steam coal exporters.

| TABLE IX. TONNAGES AND QUALITIES FOR THE MAIN EXPORTING COUNTRIES THERMAL HARD COAL | | | | | |
|--|-----------------------------------|-----------------------------------|--------------------------|------------------------|------------------------------------|
| EXPORTER | EXPORTS- 1991 (Mt) | EXPORTS- 2000 (Mt) | NCV (kcal/kg) | SULPHUR (%) | SULPHUR PER THERMIE(g) |
| Australia | 54 | >85 | 6600 | 0.75 | 1.14 |
| S. Africa | 43 | 65 | 6200 | 0.90 | 1.45 |
| USA | 34 | 40 | 6800 | 1.15 | 1.69 |
| Colombia | 15 | >35 | 6700 | 0.80 | 1.19 |
| Poland | 8 | <5 | 6500 | 1.00 | 1.54 |
| Indonesia | 7 | <30 | 6000 | 0.80 | 1.33 |
| Venezuela | 3 | >10 | 6700 | 0.80 | 1.19 |
| China | 12 | <20 | 6300 | 0.95 | 1.51 |
| TOTAL | 176 | | 6500 | 0.90 | 1.39 |

What is clear is that there is a huge amount of low sulphur coal available both in terms of reserves and in the current international trade.

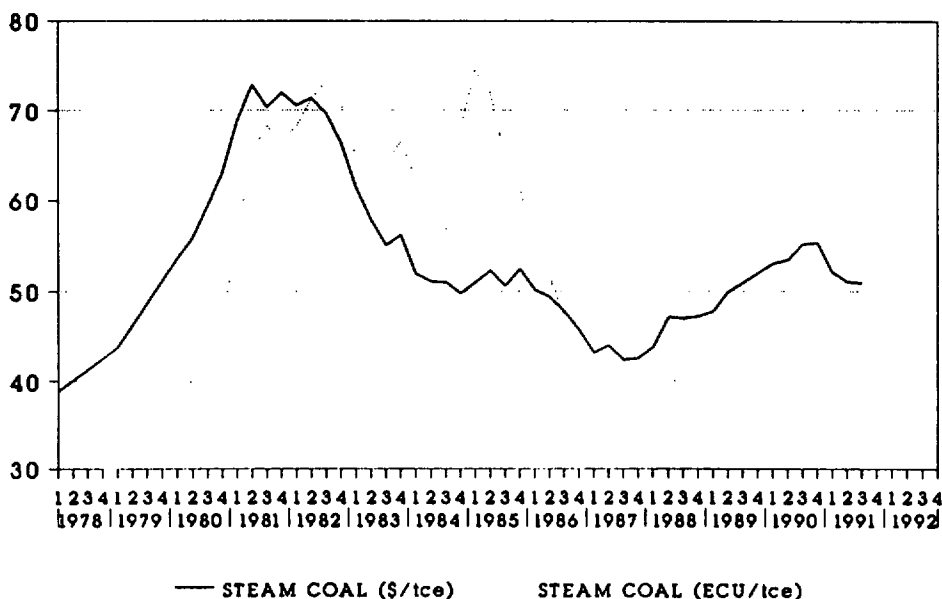
Proven hard coal reserves with a low sulphur content in the main exporting countries, excluding the Eastern Europe countries, the CIS and China, are estimated to be well above 100 billion tonnes. Most of this is located in United States and, to a lesser extent, in Australia and South Africa. Furthermore, there is a large potential for new coalfields, and thus increased reserves, in Colombia, Venezuela and Indonesia.

With regard to the prices for imported steam coal, an important fact to note is the strength and imperturbability of the international coal market with respect to the fluctuations and instability seen in other energy markets, at least during over short time spans. In fact, the average CIF steam coal prices have been significantly more stable than the fuel oil prices, in real terms, over the last twenty years. This can be attributable both to a sluggish spot market and an ample, and diverse, supply with real competition between suppliers. A large proportion of the price fluctuations are the result of changes in the exchange rates between Community currencies and the American dollar.

The relative costs of high and low sulphur coals are difficult to assess, especially since factors such as quality variations and local versus imported coal can cut across the differentials related to sulphur content. In traded coals, sulphur content currently appears to have little impact on price. Even in some Community countries imported low sulphur coals can be lower in price than domestic high sulphur coals because of the higher domestic production costs.

To identify currently any type of premium for international traded coals is difficult, with the exception of where both high and low sulphur coals are produced in locations that are not far apart or are being used to meet emission standards. However, some kind of low sulphur premium cannot be excluded when the only alternative is the installation of emission control equipment. The upper limit of any low sulphur coal premium would be determined by the cost of alternative approaches to controlling sulphur emissions.

AVERAGE CIF COST OF COMMUNITY IMPORTS OF STEAM COAL



3.3.1. THE UNITED STATES

The United States has been one of the world's major coal producers for more than a century. The USA has also been a major exporter of coal. Historically, US coal exports have been predominantly metallurgical, in spite of the fact that some 93% of the domestic consumption comes from the

generation of electricity.

The United States is also the largest supplier of hard coal to the Community and shares the leading position with South Africa for coal of thermal quality. At the same time, it is the only country that sells significant tonnages with a sulphur content higher than 1% to third countries. The average sulphur content for thermal coal exports is estimated to have been 1.15%, or 1.69 g per thermie, in 1991.

| | PRODUCTION | EXPORTS | |
|--------------|------------|-------------|-------------|
| | | TOTAL* | Into EEC |
| Steam coal | 740 | 40.2 | 23.9 |
| Coking coal | 90 | 58.6 | 28.8 |
| TOTAL | 830 | 98.8 | 52.7 |

* Including exports to Canada

Most of the US coal basins are located at a great distance from the export ports and the combination of mine costs and inland freight costs makes the USA, in general, a high cost supplier of thermal export coal. However, with such a large production it only takes a few per cent of US producers to have exceptionally low production costs and/or transport costs for sizable quantities of competitive thermal coal to be available for export. The US coal industry has demonstrated that it can swiftly turn on, and off, the export supply tap as prices move up and down.

In addition there is a reasonably well developed port infrastructure on the Gulf coast (for example, New Orleans, Mobile, etc.), on the East coast (for example, Hampton Roads, Baltimore, Philadelphia, etc.) and on the West Coast (Long Beach/Los Angeles). Indeed, Hampton Roads and Baltimore in the East coast account for some 53% and 9%, respectively, of the total US coal exports. On the other hand, exports by the West coast ports represent less than 3% and most of this is for the Pacific region.

In broad terms, much of the coal from the western USA is greatly inferior to that of the eastern basins in terms of specific energy, coking ability and proximity to markets. The former, however, has the advantage of a low sulphur content and low mining costs which more than compensate, at least for the domestic thermal coal market.

| PORTS | TOTAL EXPORTS | | | EXPORTS TO THE EEC | | |
|---------------|---------------|-------------|-------------|--------------------|-------------|-------------|
| | STEAM COAL | COKING COAL | TOTAL | STEAM COAL | COKING COAL | TOTAL |
| Lower River | 11.2 | 2.8 | 14.0 | 7.2 | 0.6 | 7.8 |
| Mobile | 1.4 | 6.4 | 7.8 | 0.6 | 2.3 | 2.9 |
| Philadelphia | 0.3 | - | 0.3 | 0.2 | - | 0.2 |
| Baltimore | 6.3 | 2.6 | 8.9 | 5.4 | 0.9 | 6.3 |
| Hampton Roads | 10.2 | 42.1 | 52.3 | 10.0 | 24.8 | 34.8 |
| West coast | 2.7 | 0.1 | 2.8 | - | 0.1 | 0.1 |
| Others | 8.1 | 4.6 | 12.7 | 0.5 | 0.1 | 0.6 |
| TOTAL | 40.2 | 58.6 | 98.8 | 23.9 | 28.8 | 52.7 |

Northern Appalachia, the Illinois Basin and part of Southern and Central Appalachia could be considered as areas where either the continuing availability of low sulphur coal, at a low cost, is in question or where, at any rate, abundant supplies of high sulphur coal will be increasingly surplus to preferred domestic requirements. It is therefore reasonable to expect that low sulphur coal will continue to be in greater demand than high sulphur coal, and this will probably be reflected in the price of low sulphur coal. In addition, scarcity factors are also likely to be manifested first of all in the availability of the lower cost low sulphur coals, which will result in some pressure on costs and therefore on prices. The current low cost of low sulphur coal could also be affected by the increasing costs of the various cleaning processes required to reduce sulphur levels to comply with US regulations. Therefore, to summarise, whilst it is recognised that coal prices generally will not show significant real increases in the period up until the year 2000, the price of low sulphur eastern coal could rise more significantly.

US coal production, for export purposes, can be divided into seven major regions: Northern Appalachia, Central Appalachia, Southern Appalachia, the Illinois Basin, the Rocky Mountains, the Powder River Basin and Alaska.

a) Northern Appalachia

The coal production in Northern Appalachia is largely of high, and medium, sulphur bituminous for use by the electricity generation utilities and by the metallurgical industry for coke making. However, this coal is generally too high in sulphur to have a large demand from European buyers. The region is connected by railways to the ports of Baltimore and Philadelphia.

The sulphur content of coal in this region is typically 1.5-3.5% and only about 10% of the reserves contain less than 1.5% sulphur. There is virtually no coal with a sulphur content less than 1.0%.

b) Central Appalachia

This region is the largest supplier of USA export steam coal. The region is well served by railways to the major ports at Hampton Road, Baltimore and Charleston, and much of the coal is relatively close to the barge terminals on the Ohio River.

The majority of the coal produced is high quality, low sulphur, steam coal and premium quality metallurgical coal. The average sulphur content ranges between 0.7 and 1.0% and the heat content between 7000 and 7500 kcal/kg.

c) Illinois

In the Illinois basin the coal quality is only mediocre with a typical calorific value of 5800 - 6400kcal/kg and a 1.5 - 3.5% sulphur content. Most of the lower sulphur coal (coal with a sulphur content of less than 2%) has already been mined. In addition, the ash content is relatively high and the low ash-fusion temperature makes this coal unacceptable for many boilers. For this reason, the coal is not very attractive for export. There is, however, an infrastructure available for exports either by railway to Mobile or by barge to New Orleans.

d) Rocky Mountains

In the Rocky Mountains region, which is located in the centre-west of the USA, in the States of Colorado, Utah and southern Wyoming, the coal produced is generally of a low sulphur content (0.5 - 0.6% on average). The calorific value increases as one moves south and west.

Southern Wyoming coal is sub-bituminous and contains around 5400 kcal/kg. Steam coal in Colorado is also sub-bituminous but the specific energy content is somewhat higher at 5800 kcal/kg. Utah steam coal is bituminous and contains around 6900 kcal/kg.

Logically sub-bituminous coal is not very attractive for export. In addition this coal is penalised by the long distances to the main ports, which are essentially Long Beach/Los Angeles in the Pacific coast.

e) Powder River Basin

The Powder River Basin, located in the States of Wyoming and Montana, produce a sub-bituminous coal with a low sulphur content (on average between 0.3 and 0.5%) and a low ash content, with a specific energy content of some 4500 - 5300 kcal/kg. The export potential, however, is very low due to the coal quality and the inland transport costs (which are between twice and three times the total production cost). Therefore, unless freight costs can be drastically reduced, or coal become in such tight supply (which appears extremely unlikely), the export potential will remain low. However, this basin is connected by rail to the north western port of Astoria and with the Gulf of Mexico ports of Galveston and Mobile both by rail and barge.

3.3.2. SOUTH AFRICA

The Republic of South Africa is currently the second largest supplier of hard coal to the Community and shares the leading position with the United States for coal of thermal quality.

The coal deposits of the Republic of South Africa occur in five major basins which are located in the north and east of the country. Among them, Main Karoo basin is the most internationally important and developed.

These deposits contain high-volatile, weakly caking, bituminous coal and anthracite. The indicative characteristics of South African coal are shown in the table below.

| | |
|------------------------|-----------|
| Ash | 12-18 |
| Sulphur | 0.6-1.5 |
| Moisture | 7-10 |
| Heat content (kcal/kg) | 5800-6500 |

South Africa exports sales are constrained by the limited port infrastructure and in fact exports accounted for a tonnage only a shade below the rated capacity of the three coal export terminals. With the decision to extend the Richards Bay port to handle a total capacity of some 53 million tonnes a year a fresh phase of expansion has been introduced into export oriented coal production.

Total production and exports are shown in the table below:

| TABLE XIII. SOUTH AFRICAN PRODUCTION AND EXPORTS 1991 | | | |
|--|------------|---------|----------|
| (million tonnes) | | | |
| | PRODUCTION | EXPORTS | |
| | | TOTAL | Into EEC |
| Steam coal | | *42.4 | 24.7 |
| Coking coal | | 3.3 | 0.5 |
| TOTAL | 171 | 45.7 | 25.2 |

* Including some 3.2 million tonnes of anthracite

Although the typical range of sulphur content of South African coal is between 0.6 and 1.5%, only marginal tonnages are exported with a sulphur content higher than 1%. In fact, the average sulphur content for the total thermal coal exported was around 0.9%, or 1.45 g per thermie, in 1991.

In addition, it should be noted that South Africa has the lowest FOB total cost of any of the existing coal exporting countries.

3.3.3. AUSTRALIA

Australia is currently the world's biggest exporter of coal, and the third supplier of coal to the Community. Of the total amount of around 20.1 million tonnes imported into the Community during 1991, less than 10 million tonnes were of steam coal quality.

The most internationally important basins are located in the states of New South Wales and Queensland.

The basin of Queensland (Bowen) has been a major source of coking coal for supply to the international coal market. The coal is high-volatile, strong caking with variable ash but with a low sulphur content, usually below 0.7%, and a heat content from a minimum of 6400 kcal/kg up to a 7780 kcal/kg. The basin is linked by rail to the major exporting facilities such as Gladstone, Hay Point and Abbott Point.

The Basin in the State of New South Wales (Sydney) has a coal of similar characteristics to that of the Bowen basins, with sulphur contents ranging between 0.3% and some 1%, with variable ash ranging from 6% to 20% and calorific values from 6200 to 7800 kcal/kg. This basin is linked to the major coal exporting ports of Newcastle and Port Kembla.

| TABLE XIV. AUSTRALIAN PRODUCTION AND EXPORTS IN 1991 (million tonnes) | | | |
|--|------------|---------|----------|
| REGION | PRODUCTION | EXPORTS | |
| | | TOTAL | Into EEC |
| New South Wales | 95.7 | 53.6 | |
| Queensland | 79.0 | 66.0 | |
| TOTAL | 174.7 | 119.6 | 20.1 |
| Of which: | | | |
| - Steaming | 104.0 | 55.0 | 9.9 |
| - Metallurgical | 70.7 | 64.6 | 10.2 |

The average sulphur content of its thermal hard coal exports was around 0.75% in weight in 1991 or 1.14 g per thermie. In addition, it should be noted that there were no exports with a sulphur content above 1%.

3.3.4. COLOMBIA

There are some thirty-five coalfields located within the north-western region of Colombia. However, El Cerrejon and, in particular, Cerrejon North is the most internationally important and most developed coalfield. There is great potential for further hard coal mining developments for export in the La Jagua de Ibirico basin, where some mining operations such as El Descanso, El Boqueron, Calenturitas, and La Jagua are at different stages of development.

Indicative coal characteristics for coal from some of the coalfields are the following:

| COALFIELD | SULPHUR (%) | NET CALORIFIC VALUE (kcal/kg) |
|--------------|-------------|-------------------------------|
| Cerrejon | 0.6 - 0.9 | 6500 - 6800 |
| Calenturitas | 0.4 - 0.6 | 6500 |
| La Jagua | 0.7 | 6800 |
| Oreganal | 0.5 | 6700 |

Average coal exports totalled 15 million tonnes in 1991, of which more than 80% originated in North Cerrejon. European Community imports from Colombia were 8.4 million tonnes in 1990 and are estimated to have been around 10.1 million tonnes in 1991.

The average sulphur content of the total hard coal exports was around 0.8%, or 1.19 g per thermie, in 1991. No exports had a sulphur content higher than 1%.

Colombian exports are expected to expand to more than 35 million tonnes by the year 2000, and the European Community is expected to absorb an important share of this tonnage.

3.3.5. CANADA

The main coal-bearing region is located in western Canada and stretches from the lignites of Southern Saskatchewan, across Alberta and into British Columbia. Bituminous coals extend into north-eastern and south-western British Columbia. The other main coal-bearing region is located in eastern Canada.

The main production areas of bituminous coal with export possibilities are the Foothills and Mountains regions.

Foothills is an internationally important, developing, region containing high-volatile, non-caking coal with generally a low ash and a low sulphur content. It can be defined as excellent steam-raising coal.

Mountains is the other important region. The deposits lie in Alberta and British Columbia. The

reserves consist of low volatile, strongly caking bituminous coal with a low ash and a low sulphur content. Some of this coal is suitable for metallurgical coke-making.

In Eastern Canada there are some deposits (New Brunswick and Nova Scotia) but they are fairly high-sulphur coking coals.

| REGION | SULPHUR (%) | HEAT CONTENT (kcal/kg) | SULPHUR PER THERMIE (g) |
|---|-------------|------------------------|-------------------------|
| - Southeastern British Columbia | 0.4-0.5 | 7700 | 0.58 |
| - Northeastern British Columbia and western-central Alberta (Mountain Belt) | 0.37-0.5 | 7700 | 0.56 |
| - Western-central Alberta (Outer Foothills Belt) | 0.25-0.5 | 6100 | 0.4-0.8 |
| - Western British Columbia | 1.0-1.1 | 6800 | 1.5 |
| - New Brunswick | 0.5 | 7350 | 0.68 |
| - Nova Scotia | 0.6-1.0 | 6450 | 1.24 |
| | 1-2.5 | 7400 | 1.4-3.4 |

Canada's thermal coal export business is intricately bound up with its coking coal business. About half of the thermal coal exports are from mines which mainly produce coking coal. The principle constraint for Canadian coal is the high FOB pier cost due to the relatively high operational costs together with the long transportation distances to the ports, in spite of the efficiency and the flexibility of the Canadian railway system. In addition, most of the Canadian exports are from the western coast, whilst only small tonnages are exported from the eastern coast, mainly from Nova Scotia and New Brunswick. Current Community imports of steam coal only represent slightly more of 1% of the total Community thermal imports.

| | PRODUCTION | EXPORTS | |
|--------------|-------------|-------------|------------|
| | | TOTAL | Into EEC |
| Steam coal | 10.6 | 5.3 | 1.0 |
| Coking coal | 29.3 | 28.2 | 2.8 |
| TOTAL | 39.9 | 33.5 | 3.8 |

3.3.6. INDONESIA

Indonesia has emerged recently onto the international steam coal trade scene but will gain in importance in the coming years. Over the last five years, Indonesia has increased its coal production fivefold, and in the next three years output is set to more than double to around 35-40 million tonnes. The exportable surplus is expected to rise from just under 5 million tonnes in 1990 to over 25 million tonnes a year in 1995.

The main production areas are located on the islands of Sumatra and Kalimantan. The characteristics of the coal are a very low ash and sulphur content although, in some cases, the coal has a high moisture content. A significant volume of the coal produced has a sulphur content below 0.6%, with a range from 0.08 to 0.95%, and a calorific value ranging between 6000 and 7100 kcal/kg.

The mining costs of the exporting mines are extremely low, and the cost of transport to the ports is also low. Overall, costs are thought to vary from US\$13 to US\$25 per tonne FOB.

Indonesia is currently making strenuous efforts, over the medium term, to be in the top five largest world exporters of hard coal.

3.3.7. COMMONWEALTH OF INDEPENDENT STATES (former USSR)

Hard coal production in the Commonwealth of Independent States (CIS) is split roughly half and half between the European part of the country and the Asian part. In the European half, most of the coal is bituminous and mined by underground methods; in the Asian part about half of the coal is bituminous (produced by underground mines) whilst the remainder is largely accounted for by strip-mined, low rank, coals. There are virtually no premium quality coals in the CIS comparable with those now being traded internationally. There are, however, substantial quantities of medium quality low sulphur coals available.

Coal is transported over the long distances principally by rail. In addition, there are essentially three ports dedicated to coal: Vostochnyy and Nakhodka on the Pacific coast and the much smaller port of Il'ichevsk on the Black Sea coast.

Total exports to the Community were around 5.3 million tonnes in 1991, almost all of which was of thermal quality. If the Ex-Soviet Union follows the Polish route, then both production and demand measured in millions of tonnes of coal equivalent will almost certainly fall. What this means for any discretionary output available for export is unclear. A large increase, however, is unlikely since the low cost mines are located at a great distance from the ports, and the ports themselves have only a limited capacity to handle additional coal.

The sulphur content for the Ex-Soviet Union hard coal exports is generally lower than 1%

| COALFIELD | SULPHUR (%) | CALORIFIC VALUE (kcal/kg) | SULPHUR PER THERMIE (g) |
|-----------|-------------|---------------------------|-------------------------|
| Jahutien | 0.3 | 6250 | 0.48 |
| Kuznetsk | 0.4 | 6050 | 0.66 |
| Petschora | 0.6 | 6350 | 0.95 |

3.3.8. POLAND

All Polish hard coal is produced from underground mines. Most of this comes from the Upper Silesian coalfield, although there are two other minor coalfields, the lower Silesian coalfield and the Lublin/Chelm coalfield.

Most of the coal movements are made by rail and the country possess enough port capacity to handle the expected export tonnages of coal.

Total hard coal production was around 139 million tonnes in 1991, with an average sulphur content of some 0.79%, in a range from 0.41% to 1.2 %, and calorific value ranging between 4900 and 7250 kcal/kg.

Total exports were some 13 million tonnes in 1991, of which 6.1 million tonnes were received by the European Community. Some 80% of this was of thermal quality. The average sulphur content for the

thermal coal exports was around 1% in weight, or 1.54 grammes per thermie.

Total Polish exports in the future are likely to decrease as Poland undergoes a monumental economic experiment in which every industry will be transformed. The coal industry is at the forefront of these changes. It is therefore highly probable that the rationalisation programmes will lead to a slimmer and fitter coal industry concentrated on the lower cost pits producing low sulphur coals. In short run, however, production will almost certainly continue to fall.

3.3.9. CHINA

China is currently a minor league coal exporter which accounts for around 3% of the international market. However, China has overtaken the United States to become the world's largest producer and thus, whilst it is difficult to put any figures on future Chinese coal exports, it is clear that China certainly has the potential to become a major steam coal exporter. The most important factor to note is that the presence of substantial low-cost supplies from China would put a strong downward pressure on the world-wide coal prices. However, should China intend to increase its presence in the international coal scene, it will not only have to offer competitive prices but also the qualities (sulphur) demanded by the potential coal buyers, especially when one considers the current surplus on offer in the international market.

Nevertheless, this should not present important problems for a country producing more than 1000 million tonnes per year and exporting only 12 million tonnes; that is to say slightly more than 1% of its total output, as the small tonnages of suitable coal can be directed for export.

The main coal exporting area is the north central region (Liaoning, Shansi, Shantung, etc.) which is linked to the port facilities of Qinhuangdao and Shijiusuo.

The average sulphur content of total exports in 1991 is estimated to have been below 0.95% or 1.51 grammes per thermie.

4.0 CONCLUSIONS

Both domestic and internationally traded coal must be considered when we wish to examine the availability of coal with a low sulphur content (less than 1.5 g per thermie).

The existing technology available for burners in furnaces of a power range of between 50-100 MW allows not only classified coals to be burnt but also unclassified coals in a wide particle-size range

Currently, all the Community countries have recourse to the international coal market to cover their total coal requirements. Four of them (United Kingdom, Germany, Spain and France) have a significant domestic production whilst for most of the remainder the international market is the only source for coal supplies.

Germany, France and Spain produce important tonnages with a low sulphur content. In Germany just under half of the total production, of some 73 million tonnes in 1991, has a sulphur content lower than 1.5 gramme per thermie (of which some 3 million tonnes are classified coals) whilst in France the annual output of low sulphur thermal coal is some 5.9 million tonnes. Spain produces some 2.2 million tonnes yearly of coal equivalent, which is one sixth of the total production. The United Kingdom produce little coal with a low sulphur content.

Thus there is a total annual Community production of hard coal of around 35 million tonnes which, given its sulphur content, would be able to meet an uncontrolled SO₂ emissions level of lower than 2000 mg/m³.

In practice, almost the total available tonnage of coal with a low sulphur content is subject to existing deals with the power stations, i.e.: France and Spain. On the other hand, in the United Kingdom and France coal production with a low sulphur content is located in the peripheral national regions such as Scotland and Lorraine, respectively, in such a way that the potential utilisation by industries at some distance from these coalfields does not appear to be a realistic possibility, mainly due to the cost of inland transport which would lead to the delivered prices being uncompetitive when compared to both coal from third countries and to alternative fuels, despite the fact that both those countries have the lowest average production costs of the Community.

This large volume of coal could give the mistaken impression that the current indigenous production of hard coal with a low sulphur content would be enough to satisfy the potential future Community demand from new plants with a power ranging between 50 and 100 MW.

Nothing could be further from the truth due to the high production costs of Community coal in most of the pits. The use by industry of Community coal would be uncompetitive compared to hard coal imported from third countries or even compared with alternative fuels, if no aid were granted either to the coal producers or to the coal consumers. This leads to the situation in which, despite the fact that coal is free to move within the Community, intra-Community trade of indigenous thermal quality coal is practically nonexistent. The prices that producers receive for their exports within the Community are generally in line with those from non-Community countries and, taking into account the higher Community production costs, are therefore not profitable.

The international hard coal sea-borne trade moved some 369 million tonnes in 1991, of which more than 200 million tonnes were of thermal coal quality. In the same period, the Community imported some 129 million tonnes of hard coal, of which 90 million tonnes were of a thermal coal quality. Eight countries, supplying altogether some 95% of the total world hard coal trade, are the main hard coal exporters: the United States, Australia, South Africa, Colombia, Poland, Canada, the CIS and China. These countries account for more than 96% of total Community imports.

Around 80% of total thermal coal internationally traded had a sulphur content lower than 1% in weight or some 1.5 gramme per thermie. This is of a quality which would be able to meet the emission limit of 2000 mg/m³ by itself in a conventional boiler that had no other emission control. The totality of the hard coal in the international market from Australia, Colombia, Indonesia, China and the CIS have a low sulphur content. To this group could also be added South Africa and Canada, since only very marginal tonnages surpass a sulphur content of 1%. Only the United States trades significant volumes of hard coals with a sulphur content above 1%, although it must be added that most of its exports are low sulphur coals.

It can therefore be concluded that there is no shortage of low sulphur coals in the international market. However, it must be noted that the coal available falls dramatically as the cut-off point for the sulphur content is reduced. By way of an example, only just over 10% of the thermal coal internationally traded has a sulphur content lower than 0.7%

Even when low sulphur coal, either as mined or washed, is available at a competitive price, there may still be some barriers to its use for sulphur emissions control. Barriers to the use of low sulphur coal can also arise where no local supplies are available and government energy policies restrict the import of supplies from elsewhere. Such restrictions may take the form of import quotas, such as those which exist in the Federal Republic of Germany and Spain. In these countries the maximum amount of coal which can be imported is set annually within each user sector by the government. In Spain, imported coal is also subject to a system of licenses. However, it should be noted that available quotas have never been fully used in the past and licenses are readily granted to the industry at present.

A further barrier to the use of non-local low sulphur coal is the availability of a suitable infrastructure for imports, or the distances to the place of consumption, which could ensure that costs make the coal uncompetitive with respect to other alternatives to control emissions.

The decision between the options of switching to low sulphur coal compared with the installation of control equipment is very site-specific, and highly sensitive to any changes in the assumptions about fuel supply conditions and the cost of control technologies. Use of low sulphur coal is likely to be more cost-effective where transport costs for imported low sulphur coal could be minimised.

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