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COMMISSION

GENERAL OBJECTIVES STEEL 1980 TO 1985

INTRODUCTION

With these General Objectives, the Commission is for the seventh time presenting long-term forecasts for the Community steel market, although it is the first time that they have covered the enlarged Community. It was first necessary to carry out extensive preliminary statistical work in which both the private and the public sectors in the new Member States fully cooperated.

Following the pattern of previous General Objectives, the first part investigates the long-term trends in steel demand, starting with an analysis of historical developments and then going on to the forecasts, which are based more or less closely on it. As in the General Objectives for 1965 and 1970, these estimates are shown separately for each steel-using sector of the economy. The input-output method was used for most countries, its advantage being that it enables account to be taken of changes in the industrial structure which will probably be of even greater significance in the future. The chapter on external trade in steel devotes particular attention to changes in conditions of competition as a result of the headway being made by the newer steel producing countries with their plentiful raw material and energy resources. The influence of various trade policy measures such as the establishment of free-trade areas with a number of countries is also discussed.

Then estimated demand is compared with expected production potential to determine whether steel supply and demand will balance in the long term. As will be seen, this is not so at all production stages. This part of the General Objectives provides guidance for the future expansion of capacity to which specific reference is made in Article 46 of the ECSC Treaty. This analysis is one of the most important sections of the General Objectives.

The analysis of supply and demand cannot, however, be confined to the quantitative aspects. To cope with the increasingly stringent requirements of the user industries and the competition from newer producing countries with plentiful raw material resources, the Community steel industry must press on resolutely with its efforts to improve the quality of its steel products. Consequently far more attention is paid to the development of steel product quality in these General Objectives than in earlier ones.

Particular importance is also attached to the forecasts for labour requirements. Earlier General Objectives contained only two overall forecasts for the Community as a whole, but this time estimates of labour requirements per country and per region have been prepared. Because the growth of production capacity will vary from place to place, it was necessary to break down the forecasts of labour requirements by region in order to provide meaningful and useful guidance for all those concerned. The forecasts are intended as far as possible to provide a sounder basis for a forward-looking social policy and to enable employers to adapt at an early stage to changes in regional employment levels.

Another equally important section of the General Objectives is devoted to the supply and consumption of raw materials and energy, with the emphasis on structural modifications in supply and changes in the use of raw materials and energy resulting from technical progress or international competition.

Because of the special difficulties that arise from the price and at times the quantity aspects, the chapter dealing with energy problems, formerly confined to coking coal, has now been extended and these General Objectives now provide the reader for the first time with a survey of the complete energy requirements of the Community iron and steel industry.

Special efforts have been made to estimate scrap availabilities. The decline in own arisings in the steel industry, primarily due to the rapid advance of continuous casting and the higher specific scrap input, partly because of the disproportionate increase in electric melting shops, have recently caused an extreme shortage on the scrap market. As it was not certain whether this shortage would continue in the long term, a special survey in each industrial sector has been conducted to investigate the availability of prompt industrial scrap in the user industries. For the first time, this had made it possible to establish detailed ratios for scrap arisings for the Community by means of which the availability of prompt industrial scrap can be calculated from the estimated steel consumption of the various sectors, allowance being made for the effect of the changing industrial structure. The availability of capital scrap has already been analysed statistically to a great extent, but in the course of the survey referred to above a considerable amount of significant information was collected from industry.

In the context of raw material supplies, a special forecast has been prepared for foundries, which largely use the same raw materials as the iron and steel industry. This has made it possible to complete the estimates of supply and demand for pig iron and scrap and to draw better conclusions on the supply of both sectors.

The consumption and supply of alloying elements has also received special attention. Through the preparation of estimates for the various categories of special alloy steels, a better idea has been obtained of the demand for the different alloying elements.

This year the General Objectives contain for the first time a chapter on financing requirements and potential resources to cover them. This is justified by the vast capital often required to construct modern production plant, giving rise to special problems that must be solved if the necessary expansion of capacity is to be attained and if the steel industry is not to become excessively indebted. Consequently it was thought necessary to devote a separate chapter to these questions.

To conclude this review of the chapters of the General Objectives 1980 to 1985, mention should be made of the chapter on the objectives and means of the long-term steel policy, which also appeared in the last version, but which this time brings out more strongly the political nature of the General Objectives.

It has not been possible to give a complete answer to all questions in the General Objectives. For example, the long-term development of specific steel consumption was investigated particularly closely but because of its complex and manifold nature it was impossible to provide a complete answer. Further studies will have to be carried out in this field.

The same applies to the demand for special steels. Efforts were made to prepare estimates, but the lack of harmonized statistics proved a major obstacle. Here too the work must be continued.

It was only possible to make quantitative forecasts regarding future labour requirements. The question of qualitative trends had to be left open as comprehensive special studies would have been required and could not have been carried out in the time available. However, they will later be regarded as one of the urgent tasks.

From the start of the preparatory work, the present General Objectives have been drafted in close cooperation with steel producers, trades unions, steel users, dealers and government representatives who aided the Commission in a consultative capacity. All these groups have made a valuable contribution by participating in the work or supplying information. Of particular value were the numerous contributions from the steel industry and the assistance of the foundry associations, experts in alloying elements and steel users, whose participation in the survey of specific steel consumption and ratios of scrap arisings deserves special mention.

The work with these groups was followed at the highest level by a steering committee which discussed the general work schedule for the General Objectives

1980 to 1985 at its first meeting on 25 October 1973 and recommended the inclusion of a chapter on financing problems and another chapter embracing all sources of energy. The steering committee has then took note of the progress of the work and gave its opinion on a number of fundamental problems.

The various groups were involved in the drafting of the chapters of the General Objectives at expert level in numerous working parties. Reports on this work were always sent to the steering committee. Because all the groups concerned participated in the work, it was possible from the start to take their wishes and ideas into consideration as far as possible. The close cooperation between these groups also paved the way for the later introduction of a coherent steel policy based on the General Objectives and pursued by all those concerned. Finally the General Objectives were submitted to the Consultative Committee and a group of government representatives.

However, the Commission bears sole responsibility for the General Objectives imposed on it pursuant to Article 46 of the ECSC Treaty.

The task of carrying out the studies and preparing the actual forecasts was in many cases entrusted to scientific establishments or experts to whom grateful thanks are due for their valuable contribution to the General Objectives. They included the Nederlands Economisch Institut, the Bureau d'Information et de Prévisions Economiques, the IFO Institut für Wirtschaftsforschung, the Centre di Studi et Piani Economici, the Department of Applied Economics of Cambridge University (internal steel consumption), the Instituto di Economica Politica of Milan University (external trade in steel), the Arthur D. Little Institute (financing problems), Mr E. Schneider (employment), Dr D'heil, Mr Jenkins, Mr Mazziotta (scrap arisings), Dr Esch (foundries), Mr Briens and Mr Botzenhardt (energy), Mr Scarpelli (alloying elements), Dr Schlüter (steel quality) and various other experts who made contributions. These studies form one of the most important foundations for the preparation of the General Objectives. In some cases the Commission for various reasons found it necessary to depart from the results of the preparatory studies; this should not be taken as any reflection on the scientific value of the work done, but was merely a question of the Commission's economic policy aims.

The forecasts on this occasion are subject to a significant margin of uncertainty as general economic development is handicapped to an unprecedented extent by factors such as the general inflationary price increases, the rise in energy and raw material costs, balance of payments deficits and the instability of exchange rates. In addition uncertainties arise here and there from the changes in traditional social and economic structures. It is extremely difficult to predict how these problems will affect the future growth of industrial output, but in general it is safe to say that not only will economic growth in general be affected but the industrial structure will also undergo certain changes. In no Community country can economic policy be solely directed towards maximum growth; in order to curb inflation and avoid excessive balance of payments deficits, which characterises several countries, it is instead necessary to aim at a certain restriction of purchasing power and this in general results in a lower rate of economic growth. Economic development has therefore entered a new phase in comparison to the Fifties and Sixties and this will also make its mark on steel consumption.

Of course an effort was made to take the new conditions into consideration, but it emerged very clearly just how unreliable precise forecasts are at this time. The uncertainty about long-term economic development and the resultant question marks in the forecasts of steel demand have made it advisable to set a lower limit for steel output in these General Objectives. This is intended to provide companies with guidance for their rationalization projects. It appears extremely important for all those concerned not only to think of the provision of the necessary capacities but also to take all the necessary measures to ensure that in periods of low capacity utilization the Community iron and steel industry is able to hold its own without major damage.

Another reason for the inclusion of the lower limit is to ascertain the effects on employment resulting from that situation.

The present General Objectives should permit the leadership of the companies and of the trade unions to have insight into the future of not only the steel market but also of its economic, industrial, political and social components. For this reason they consist not so much of a detailed scientific analysis as of a report on the major lines of development and vital problems arising in the economic and social field. The upper limits for steel consumption, exports, steel output, employment, etc. are target figures which are for information only but nevertheless call upon all those concerned to take common action.

OBJECTIVES AND MEANS OF A LONG-TERM STEEL POLICY

Article 2 of the Treaty establishing the European Coal and Steel Community (ECSC Treaty) states in relation to the aims of the Community: 'The Community shall progressively bring about conditions which will of themselves ensure the most rational distribution of production at the highest possible level of productivity, while safeguarding continuity of employment and taking care not to provoke fundamental and persistent disturbances in the economies of Member States.'

Following this general definition of the broad aims of the Treaty, Article 3 lists various tasks to be carried out by the institutions of the Community. These include the orderly supply to the common market, taking into account the needs of third countries, the promotion of improved working conditions and an improved standard of living for workers, the establishment of the lowest prices, while allowing for necessary depreciation and a normal return on invested capital, and the orderly expansion and modernization of production and the improvement of quality.

The ECSC Treaty also indicates ways and means of accomplishing these tasks. Article 46 of the ECSC Treaty states: '... To provide guidance in line with the tasks assigned to the Community, on the course of action to be followed by all concerned, and to determine its own course of action, in accordance with the provisions of this Treaty, the Commission shall, in consultation as provided above ... periodically lay down general objectives for modernization, long-term planning of manufacture and expansion of productive capacity.' 'Consultation as provided above' refers to Governments, undertakings, workers, consumers and dealers). The authors of the ECSC Treaty adopt the obvious principle that the aims to be attained must first be defined before the various parties concerned, including the Commission, take measures of any kind. The preparation of the General Objectives is therefore an essential task that must precede the measures to be taken.

The General Objectives must not only provide the Commission with guidelines for its own economic policy but also form a common basis for the course of action to be followed by all concerned. The Commission is responsible for defining aims such as the steel output to be achieved, but it enables all those concerned to participate in the process so as to ensure maximum consultation in the fixing of the objectives.

The General Objectives are not mandatory, but serve merely as guidance which in no way restricts decision-making powers. On the other hand, they confront all concerned with the need to adopt a coordinated course of action.

The forecasts, which have been established, should not be considered as a portrayal of that which might eventually take place but as an indication, taking into account the changing scenario, of that which would appear to be the desirable goal. Consequently the forecasts could not be obtained by purely technical methods, i.e. by applying specific formulae, but required decisions to be taken on various alternative possibilities. For example, the forecast for external trade represents a desirable objective established on the basis of the expected future trend on the world market, but the result might have been quite different if, for example, exporting to countries covering a temporary deficit with imports had been regarded in general as a worthwhile objective justifying the increase of Community capacities.

A further feature of the General Objectives is that the forecasts are not prepared in a vacuum; the relationship between the steel industry and the general economy is taken into account as far as possible. This involves calculating steel demand on the basis of the probable activity in various steel-using sectors. The activity of individual sectors was estimated partly on the basis of macroeconomic projections, which ensures that the steel objectives are related to the general economic development.

As already mentioned in the introduction, the objectives for 1980 and 1985 have made allowance for the major changes taking place in the general economic situation, notably of the problem of inflation and of the industrialization of the Third World. As these changes will affect both general economic growth and the industrial structure, the General Objectives are not merely a straightforward extrapolation of the historical trend; rather an attempt has been made to estimate the influence that will be exerted by the most recent changes and the new structures that are emerging. In the years ahead, it will not be enough to repeat what has happened in the past; it will be necessary to achieve growth while adapting to new conditions.

If the steel industry is viewed as part of the general economy, steel policy is seen to have a reciprocal relationship with general economic policy, social policy, competition policy, environment policy, etc., the general premises of which are incorporated in steel policy but with the addition of special sectoral aspects.

Following the general considerations, the practical objectives and their consequences for economic policy and for the course of action to be adopted by all concerned will be surveyed. As the objectives are general rather than particular, only the essential amount of detail has been given. For example, demand forecasts have been limited to major product categories. Similarly, considerations of economic policy contain no suggestions for coping with detailed problems but merely put forward principles and general guidelines.

Steel consumption within the Community

If the average trend is maintained, the consumption of rolled steel products in the Community will probably increase by 2·9 % per annum from 1972 to 1980. If the estimated upper limit were to be reached in 1980, this growth rate could rise to 3·7 %. However, in view of the cyclical and structural economic problems at the present time the upper limit is unlikely to be attained. The annual growth was 4·5 % in 1965 to 1970 and 1·9 % in 1970 to 1974.

Growth in steel consumption will vary in the different Community countries over the period 1972 to 1980. In Germany and the United Kingdom, if the upper limit is reached growth should be 3·1 and 2·9 % per annum respectively, i.e. slightly below the Community average given above, while in Italy it is likely to be 4·7 %, Denmark and Ireland 4·8 %, the Benelux countries 4·4 % and France 4·1 %. These differences come mainly from the varying general growth patterns in the economies and the steel intensity, i.e. steel consumption related to gross domestic product, already achieved. The lower the general growth and the higher the steel intensity already achieved, the smaller the increase in steel consumption.

In all countries, with the exception of the United Kingdom, the growth forecast for the average trend is slightly below that of previous years. Whereas in 1965 to 1974 an annual growth of 4·4 % was attained in the Community excluding the United Kingdom, a figure of 3·0 % has been estimated for 1972 to 1980.

One of the major reasons for this reduced growth is the fact that in all countries the galloping inflation and structural changes in important economic sectors are inhibiting economic development. For the United Kingdom it has been assumed that after a period of low growth things will pick up and growth will approach the Community average.

When steel consumption is broken down by sector, marked differences emerge. The construction and motor industries in particular show below-average growth rates, while consumption for tubes, mechanical engineering and boilers and other vessels is expected to record an above-average increase. These different rates of growth in individual sectors of the economy are in turn the most important reason for the varying trends in the consumption of individual rolled steel products.

Investigations (details of which will be found in a later section) have indicated that there will be a marked increase in heavy plate and tube ingot consumption whereas light and heavy sections and wire rod will have a relatively low growth rate. These structural changes in steel demand that are taking place will necessitate adjustments in the industry which in their turn should affect investment. More will be said of this later.

The expansion in steel consumption that will actually be attainable by 1980 depends largely on the inherent momentum of the economy and the economic policy measures adopted by the authorities responsible. These measures should as far as possible take account of the special requirements of industrial sectors, including the steel industry.

For the period 1980 to 1985 a small decline in the annual growth rate — 2·7 % against the 2·9 % for 1972 to 1980 — is anticipated. Within finished products the share of flat products should once again increase slightly.

External trade in steel

Despite the predominant place occupied by internal deliveries, steel exports have always been of great importance to the Community steel industry. Although competition has increased on the world market, the enlarged Community managed to increase its steel exports from 10·5 million ingot metric tons in 1955 to about 27·4 million in 1973. The share of exports in crude steel output thus rose from 14·4 to 18·3 %. However, this increase in exports was not spread equally over all products. Exports of ingots and semis have lagged behind exports of finished rolled steel products.

In the years ahead exports could continue to increase, reaching a level of 32 to 37 million ingot metric tons by 1980. There could then be a further small increase up to 1985. However, the efforts of the Community steel industry to improve its competitiveness must not be allowed to flag.

In recent years, the construction of a number of new works and modernization of old plant, together with the efforts made on the commercial side, have helped to hold the Community's share of the world steel market steady after a long period in which it had been declining. It is also important for Community works to give preference in their export policy to products having a relatively high skilled labour content. The Community is poor in raw materials and energy but it has rich resources of skilled labour, engineers and scientists. It should therefore give priority to products in which this asset can be turned to best advantage. This means stepping up its exports of sophisticated products, including not only special steels and alloy steels but also high value ordinary steels.

The fact that indirect steel exports (the weight of steel contained in exports of tubes, machinery, etc.) are in the long term rising faster than direct steel exports also merits attention. For some years indirect steel exports, comparatively insignificant in the Fifties, have increasingly been outstripping direct steel exports.

Steel imports amount to 6 to 7 % of Community steel output. Some of these are for the steel industry itself and consist mainly of ingots and semis for further processing. There are various reasons for this, the most important being the high cost of transporting ore and coal to Community steelworks situated far inland and the costs of anti-pollution measures. On the other hand, steel industries are rapidly being developed in various countries outside the Community having rich energy and raw material reserves and able to supply the abovementioned products.

Consequently in the interests of competitiveness the benefits of the international division of labour should be accepted wherever it is more advantageous to import ingots, semis and coils, provided there is an adequate guarantee of long-term supplies and the quality requirements can be met.

Such a policy could entail social and regional difficulties to which it is essential that the Community supplies an adequate answer.

It is only rarely that finished products are imported because the product concerned is manufactured in insufficient quantities or not at all in the Community. In all other cases differences in prices and delivery periods and established commercial relations are the most important factors. To this extent imports are also of some importance as a competitive factor. On occasions in the past, considerable disturbances on the Community market have been caused by steel imports from Eastern European State-trading countries. In the circumstances where these countries apply marketing and commercial criteria which are not the same as those in existence in the Community they were therefore able to supply the Community with large quantities at very low prices, not only upsetting the quantitative balance but also depressing prices below the cost level of Community works. Imports from other countries also pose problems on the Community market, especially in periods of recession.

In 1980 imports could total about 10 million metric tons, slightly more than in 1970. In the five years thereafter, imports could increase rather more steeply, especially in the case of semis and coils. Since a growth of exports of approximately the same order is envisaged, net exports could, assuming average market conditions, reach the same level in 1985 as is forecast for 1980, namely 23 million metric tons crude steel. This forecast must, however, be subject to a higher degree of uncertainty.

One of the functions of the commercial policy is to improve the conditions for free international movement of goods. The dismantling of non-tariff barriers to trade, one of the major aims of the present world trade conference, is of particular importance for the Community's steel exports. The reduction of customs duties, especially in countries where they are still relatively high, should also promote international trade in steel.

At the same time, it is important to avoid serious disturbances of the markets as a result of abnormal conditions of competition. For this purpose there have been quantitative restrictions for a number of years on iron and steel imports into several Community countries, for reasons which have already been explained.

As these different economic systems will continue and as capacity is rapidly being expanded in the countries concerned, the quantitative restrictions on imports from them should be maintained, at least in the most severely affected Community countries and in particular in the case of sensitive products. This does not mean that imports should be frozen at a certain level; some increase in the quantities commensurate with conditions on the steel market and general considerations of commercial policy could be allowed. If the price level were to be so eroded by these imports as to jeopardize the aims of the Treaty, it might become necessary to reintroduce the earlier ban on price alignment.

The question of distortions of competition does not only arise in the above case, but is of general significance. If the steel industry in any country benefits from arbitrary competitive advantages, the steel industries in other countries will be harmed to a greater or lesser extent and the international division of labour adversely affected.

The restoration of an orderly international monetary system is also of great importance for the further development of external trade in steel. With a widely used product such as steel, monetary uncertainties are rapidly reflected in the flow of goods and can impair even traditional patterns of trade.

A further important factor affecting future external trade in steel is the industrialization of developing countries in which the per capita steel consumption is still extremely low. These countries may become important customers for both steel products and finished industrial products.

Because of the complicated processes involved in the modern steel industry and the lack of sufficient skilled labour in most of these countries, it will be a long time before they can produce large tonnages of steel. Some of them are, however, already exporting, although in very small quantities. Since 1971 these exports have benefited from supplementary measures of the generalized system of tariff preferences.

Steel supply

As shown by the surveys conducted and the analysis of other information from the industry, crude steel production potential will increase by an average of 3·9 % per annum from 1973 to 1980 assuming that the necessary investments are realized. The highest growth will be recorded by oxygen and electric steel. In 1980 these methods will account for 73 % and 21 % of total production potential. The basic Bessemer method will more or less disappear while open-hearth steel will account for only 6 %.

The technical and economic advantages enjoyed by works using the oxygen blowing method are obviously encouraging a number of companies to increase the size of their plant. In 1973 there were 14 works in the Community having a total production potential of 60 million metric tons crude steel. In 1980 this will have risen to 86 million metric tons, each plant having a production potential of four million metric tons or more. This trend is of importance because the Community steel industry can only maintain or improve its international competitive strength if it makes technical and economic advances in its plant.

As regards electric melting shops, it will be shown later that, under the conditions that the restriction of exports is continued and a relative high level of scrap prices is attained, the growth recorded is just commensurate with the maintenance of quantitative equilibrium on the scrap market. These works should, in so far as it has not already been planned, diversify their production within the realm of the possible in order to free them from their dependence on a limited range of products.

In the coastal steelworks growth in the years ahead will continue at a faster pace than in other works, but most probably the difference in the growth rate of the two types of works will narrow in the second half of the seventies.

This is mainly because for 1973 to 1980 coastal investments are serving in most cases to improve existing installations rather than to augment capacities whereas inland production potential will be increased more rapidly by the modernization of a large number of steelworks and by the construction of electric melting shops. In 1980 the share of the integrated coastal works in total crude steel production potential could be 31 % against 24 % in 1973.

One of the most remarkable features in the future development of steel supply is the rapid increase in continuous casting installations, the production potential of which will increase from 19 million metric tons in 1973 to nearly 66 million metric tons in 1980. As continuous casting requires about 15 %

less crude steel to make a finished product, it will have substantial repercussions on productivity. It is therefore in the Community's interest for the steel industry to introduce this process in order to benefit from its advantages.

A notable feature of production potential for rolled steel finished products is the fact that potential for wire rod and heavy sections is growing relatively fast. Whereas in 1960 to 1973 production of these two products increased by 4·5 % and 2·0 % per annum respectively, increases of 5·6 % and 4·0 % are expected for the years up to 1980. Production potential for flat products will probably grow more slowly than that for other products. This is mainly because of the slower growth in the coastal works and the disproportionate increase in mini-steelworks.

Equilibrium between steel supply and demand

Steel supply and demand will be balanced in the long term in so far as it is possible to bring the expansion of production potential into line with the future trend of steel demand. The first essential is to have an accurate knowledge of the future growth of internal steel consumption and the further development of net exports. Both components of steel demand have therefore been thoroughly analysed for the purposes of these General Objectives. It has emerged that in 1980, 170 million metric tons of crude steel must be produced under average conditions and 183 million metric tons if the upper limit is reached, of which exports would account for 23 and 27 million metric tons and internal consumption for 147·5 and 156·5 million metric tons respectively.

For the future the surveys conducted in the industry during the first half of 1975 have shown that production potential for 1980 may be expected to reach 228 million metric tons crude steel. As the maximum utilization of production potential is of the order of 85 to 90 %, the potential would have to be at most 215 million metric tons of crude steel in 1980 in order to satisfy the maximum demand forecast in these General Objectives. This implies that if the figure of 228 million metric tons cited above is attained there will be unused capacity even if the upper limit of demand is reached.

However the present depression will without doubt lead to a deferment of a part of the firm investment projects or even to the abandonment of certain investment plans. The Investment Inquiry 1975 (1) indicates however that many investment programmes are so far advanced that a production potential of already 213 million metric tons of crude steel will exist in 1978, and this would be approximately of the right order to satisfy the maximum demand forecast for 1980. The danger exists that, when the present depression continues and own resources remain unsatisfactory, the steel industry must finance their investment to such an extent through credit that a too high rate of indebtedness would result. The risk also exists that replacement investment destined for modernization and rationalization will not be carried out and as a result the competitiveness of the Community steel industry would suffer.

Allowing for a rate of utilization of 85 % and on the basis of forecast demand, the production potential of crude steel in 1985 should be 232 million metric tons.

As far as rolled steel finished products are concerned, an imbalance is to be expected in 1980 for wire rod, if all the investment projects are realized. The demand for this product will probably only increase slowly as in several user industries (especially the construction sector) economic growth will decline perceptibly in the medium term. In contrast, expected production potential established at the beginning of 1975 shows a sharp increase. If all the investment projects are carried out as planned, the wire rod capacity utilization rate in 1980 might be no more that 67 % even if the upper limit were attained, as compared with 84 % in the 1973 boom. The maximum capacity utilization rate for sections in 1980 could be 74 % against 78 % in 1973.

If sections are divided into heavy and light, it becomes clear that a substantial decline in capacity utilization for heavy sections would take place whereas for light sections the utilization rate could at most come close to the 1973 level. For coils the utilization rates would be about the same as those of 1973 if the upper demand limit were attained, while for other flat products and to a certain extent for sections slightly higher rates should be expected.

What has already been said for crude steel is equally valid for rolled steel products, namely that the present recession will probably lead to a reduction in investment such that by 1980 no structural over capacity — with the exception of wire rod, where expansion of capacity is already so far advanced, that a capacity surplus must result.

(1) Investment in the Community coalmining and iron and steel industries, September 1975.

The problem of the balance between steel supply and demand arises not only in the long term but also in the short term as when in periods of peak demand production potential is barely adequate to meet market requirements or when the utilization rate drops dangerously in periods of recession. Particularly violent cyclical fluctuations are a well-know feature of the Community steel market and are aggravated by variations of up to eight million ingot metric tons in stock level. These cyclical fluctuations not only cause drastic ups and downs in steel output, but also lead to substantial variations in steel prices, employment and raw material requirements. It seems likely that these cyclical fluctuations will if anything be intensified, partly because of the increasing tendency for their incidence to coincide in the industrialized countries.

The greater the boom or recession and the longer it lasts, the worse the problems caused by cyclical fluctuations. In the late Sixties a recession lasting several years caused a severe decline in income and investment capacity. At the time this report is being written there is once again a particularly severe recession which will have the economic and social results already described.

It is not the task of this report to predict cyclical fluctuations — that is a matter for the short-term forward programmes — but long-term policy must give consideration to the occurrence of severe cyclical fluctuations since in any case there will be new structural problems to be faced in the coming years. Consequently these General Objectives also contain for 1980 a forecast of a lower limit of 162 million metric tons for crude steel output. One of the objectives laid down for economic policy is to avoid too strong cyclical fluctuations both downwards as well as upwards.

The ECSC Treaty provides the Commission with a number of ways and means of influencing market events, preferably indirectly but also directly if necessary. They include the preparation of short-term forward programmes as guidelines (Article 46), cooperation with Governments to regularize or influence general consumption (Article 57), measures of commercial policy (e.g., Article 74), the fixing of maximum or minimum prices (Article 61) and the introduction of compulsory production quotas (Article 58) or the establishment of production programmes (Article 59). In the past indirect measures based on Articles 46 and 74 have been used by the former High Authority or by the Commission on several occasions.

The steel industry must devote more attention than ever to improving efficiency and cutting costs so as to survive periods of recession without major damage. The imbalances in steel supply and demand caused by the trade cycle are uselessly intensified in the event of a long-term imbalance. If production potential outpaces or lags behind the long-term increase in steel demand, short-term supply and demand imbalance difficulties are amplified. Consequently it is almost impossible to solve the short-term problems if a balance between supply and demand cannot be secured in the long term.

Development of steel grades and products

Adaptation to quantitative changes in demand, as described above, is one of the future goals; another is adaptation to the increasingly stringent quality requirements of steel users. It is in general true to say that the development of steel grades and products is largely guided by probable trends in the various user sectors. It is up to the steel industry to find production techniques that are economically acceptable and lead to the desired further development. However, further development may also be carried out independently by the steel industry and the resultant products acquire a market of their own.

Only in certain special cases in there a real need to develop new steel grades. The essential aim here will be the further development of what already exists. The first point on which future development work should concentrate is the adaptation to the special requirements of various user sectors. Examples include the improvement of heat-treatable steels for pipelines and pressure vessels and the standardization of properties, particularly in steels for mass production, such as in the motor industry. To meet these requirements, there are many problems to be solved, not only in connection with steel grades but also as regards the metallurgy of their production and testing to ensure the desired uniformity of properties.

In addition to the adaptation of existing steel grades to the more stringent requirements in the various types of application, a second important point is the general improvement of fabricating properties. First and foremost comes weldability which is of enormous importance in almost all fields. Parent metals, filler metals and welding methods must be further developed to ensure that steels which today can be welded only with special precautions will in the future be weldable at high speeds, i.e. economically, and reliably, i.e. without cracking.

The most important fabricating properties are once again machinability (which must be uniform) and cold formability. Work on these lines is required not only to improve the property concerned but also to ensure that it can be unambiguously defined by test values.

This applies not only to fabricating properties but also to the basic properties such as load capacity under static and vibratory stress. Here the values are more important than the test methods. To obtain greater economy, steel users are making every effort to use their steels as efficiently as possible. To do this, the property values they need for their design calculations must be determined as far as possible under stresses simulating service conditions. Consequently it is necessary reliably to determine the long-term heat resistance of the parent metal and welded joint not only under constant load but also under fluctuating load with superimposed temperature variations. The same applies to ordinary and high-tensile structural steels for which fatigue resistance must be determined having regard to the load aggregates occurring in service. Further knowledge of properties is also necessary for many types of stress corrosion.

These examples chosen from the many tasks outlined in the various sections illustrate quite clearly that in future research on materials must concentrate even more than in the past on the problems arising in practical applications (tests on components) in addition to the (further) development of steels.

The tasks outlined also involve metallurgy in connection with the problems of obtaining high uniformity of properties from the metallurgical aspect and also in connection with steelmaking in large units. The various possibilities of constructing large ingots by welding or successive casting generations must be explored.

There appears to be no demand for fundamentally new forms (shapes, profiles, etc.) of steel products. However, the efforts to obtain more economic fabrication of certain steel products from the coil, such as concrete reinforcing steels (for the prefabrication of reinforcing elements) and tubes (to facilitate laying) may have further consequences (e.g. the shapes of concrete reinforcing steels). Requirements arising in connection with the manufacture of the steel products concern the improvement of uniformity, surface quality, dimensional accuracy and in some cases flatness.

Production techniques

The past decades have been marked both by the introduction of significant new techniques such as sintering and pelletizing, oxygen steel-making, continuous casting, vacuum and ladle metallurgy and direct reduction, and by the construction of ever larger production units. From the technical aspect, this trend appears to be coming to an end. At present it does not seem that fundamentally new techniques, which are already applicable in the works, are on the point of appearing. As regards plant dimensions the technical and economic optimum seems to have been attained in many cases.

In the coming years, therefore, it will mainly be a matter of putting the new techniques into general industrial use, combining them efficiently with existing techniques and improving them by adding and refining certain details. Investment activity in the Community iron and steel industry must therefore in these years maintain the rhythm of the past.

Special attention will be paid to the following points: a further improvement in industrial safety and pollution control, maximum economy in the use of energy and raw materials, enlargement of the range of raw materials and types of energy that can be used, adaptation of plant to the increasingly stringent quality requirements for steel products and improvement of productivity in some types of plant.

In the area of pig-iron production, it will be necessary to improve the burden and make it more uniform, partly to replace blast furnace coke by other forms of energy and to use poorer qualities of coking coal to produce blast furnace coke. In oxygen steel plant, questions of steel quality are the most pressing; an ever larger proportion of the steels that formerly had to be made in the electric furnace can now also be produced in oxygen converters. The question of energy conservation and in particular the increase use of heat from waste gases must be investigated.

In addition to quality matters in electric furnace technology, attention must be paid to reducing energy consumption, preheating of the solid charge being an important item.

For reasons of steel quality and improved productivity, the tendency to split the metallurgical processes into a sequence of steps will continue. Ladle and vacuum metallurgy will therefore become even more important.

Steel will be cast at a faster rate in continuous casting plant. Every effort will have to be made to develop this process further so that it can be used for as many steel grades as possible.

In order to achieve better productivity in the working of steel and to meet the requirements for improved dimensional accuracy and uniformity in rolled products, it will be necessary to make faster progress in replacing old plant by new; this also applies to special heat treatment and continuous quality control installations.

At almost all stages of the steel-making process, there is also a need for improved refractory materials. In future far more attention should be paid to this sector than in the past.

Investment policy

In the steel industry as in other heavy industries, technical advances bring with them in many types of plant increases in unit capacity that are very often greater than the growth rate of total demand.

Every company anxious to modernize without giving up its traditional products is therefore tempted to replace obsolete capacity by very much larger capacities. A disadvantageous consequence of the installation of large-scale modern plant at certain production stages is the need to increase capacity up or down the line to make it commensurate with the new plant. At the same time, the scrapping of plant that has become of doubtful profitability is often prevented by government intervention or social considerations.

Consequently decisions could be taken on overall increases in capacity without sufficient reference to the forecasts of demand growth. In this case the emergence of excess capacity can be combated by consultation between companies — which obviously must not contravene the ECSC Treaty — to arrive at coordinated investment decisions or to operate jointly plant of a capacity that could not be fully utilized by one works.

The investment policy can also help to coordinate lead times with the development of demand. In order to maintain the necessary sectoral and regional balance, there must be a degree of harmonization between investment in the best situated and most modern works and the investment and scrapping of plant in other units. It is precisely 'in order to encourage the coordinated development of investment' that the Paris Treaty instituted means of intervention, the most important being set out in Article 54: the declaration of investment programmes, the delivery of reasoned opinions and the granting of financial aid within the framework of the general objectives.

Reasoned opinions on investment programmes are designed to have some effect since their content is brought to the attention of the governments and enterprises concerned and lists are published in the *Official Journal of the European Communities,* thus enabling credit institutions to request copies from the addresses where appropriate.

Investment policy should be directed not only towards quantitative results but, within the context of production objectives, towards the improvement of products, rationalization and the lowering of costs.

Types of plant that should be promoted include continuous casting plant because of the savings in crude steel, direct reduction plant where profitable operation is possible as this will improve the scrap position, other plant designed to improve raw material supplies and energy conservation or recovery and plant furthering quality improvement and quality control, such as special heat treatment facilities as well as investment for modernization and rationalization which result in substantial cost savings. With regard to crude steel, the Commission should concentrate its efforts mainly on the financing of investments already agreed upon and under way. The establishment by several companies of common facilities for the application of modern techniques without any sudden increase in capacities would be particularly opportune.

With regard to long products, the production potential, especially for heavy sections, might increase more rapidly than the demand. This question should be followed closely, and action in the form of financing should be considered as each case arises.

With regard to wire rod, investments aimed at increasing the production potential are now so far advanced that, when the new plants commence operation, there is likely to be a serious problem in respect of outlets. Loans should be granted only in exceptional cases and might be made subject to special conditions such as the closure of obsolete plant.

In the flat rolled products sector, on the other hand, the overall demand for strip and heavy and medium plate and sheet might well exceed the production capacity that will be afforded by the investments already in progress or decided upon. In this sector the Commission should not only foster such investments, but should also back other projects that are still in the blueprint stage in order that at least some of these can be implemented by 1980.

As regards the steel works, it is desirable in order to avert difficulties in scrap supply that further increases in production potential which would raise the scrap requirements above the levels estimated in these General Objectives should be avoided (1). After 1980 a further growth in internal scrap availability is expected which would permit a slight disproportionate increase in scrap-intensive steel production processes.

Credit policy

Investment in the steel industry in past years (1961 to 1971) has been financed by depreciation (60 %), long- and medium-term loans (30 %) and capital increases (10 %). Assuming that the structure of production potential falls into line with these General Objectives for the years 1974 to 1980 the total financing requirements for plant investment projects and current assets are estimated at 14·6 million u.a. at 1973 prices, corresponding to annual expenditure of about 2·1 million u.a. or 8 to 9 % of turnover.

The raising of this amount could be endangered by the following two factors:

— a lengthy recession on the steel market,

— the continuation of inflation, especially if it caused steel prices to rise less steeply than costs, including the prices of capital goods.

(1) See page 110 on this subject.

In the second half of the Sixties, the slackness on the steel market over a period of several years depressed receipts to a low level for even longer, so that investment activity was dangerously reduced. At present (1975) there is a serious recession on the steel market. If this situation continues, the same or even greater difficulties in financing investment may be experienced, and the competitive position of the Community's steel industry could be impaired.

As far as the effects of inflation are concerned, calculations that will be described in detail in a later section have shown that even if steel prices climb at the same rate as all other prices the debt ratio (debt as a proportion of total capital employed) with a 10 % inflation rate will rise from 51 % in 1973 to 61 % in 1980. Under these conditions it would be necessary to consider whether traditional sources of finance were still adequate for the steel industry and other industries in a similar position.

The answer will vary from one country and one company to another. However, if the debt ratio continues to increase there will be a danger that steel companies will be increasingly dependent on contributions from the government and other public bodies or that investment activity will be cut back to an extent that would be harmful to the economic development of the Community.

The debt ratio becomes even worse when steel prices, in contrast to the general inflation, tend to decline as they did in 1975.

All this shows how important it is for the steel industry to avoid long periods of recession and to fight inflation. The Commission, within the framework of the ECSC Treaty and the European Investment Bank, within the framework of Article 130 (a) of the EEC Treaty, can help to solve the financial problems to some extent by stepping up their loans.

It should be stressed that the Commission as the financial backer can play a useful role by granting loans even without interest rebates, for the Commission has access to all the main capital markets and can borrow funds on favourable terms which are not always open to the individual company. In the future, funds might be made available for particularly important investments subject to certain conditions such as the closure of old plant or the joint operation of a single enterprise rather than the launching of several undertakings. Thus the Commission's role acquires special importance at a time when, as a result of a prolonged recession, the resources of the iron and steel industry are no longer sufficient for the development and modernization of plant.

In accordance with a Commission Decision (published in the *Official Journal of the European Communities*, No C 73 of 18 June 1970), certain industrial loans may incorporate interest rebates.

The provisions relate to investments for the protection of the environment, investments that further the integration of ECSC undertakings, investments for the establishment of research centres or training centres, and investments aimed at relieving a bottleneck that would affect the whole of an ECSC industry.

If such a bottleneck existed, it would be possible, hitherto, for investments directed towards increased coking capacities to benefit from subsidized loans. Other investments would also qualify provided that they were intended to facilitate the supply of materials in which there was a bottleneck.

As mentioned below the Commission is also empowered under Article 56 of the ECSC Treaty to grant loans at reduced rates of interest for the creation or expansion of activities in the coal and steel industries.

Research and technological innovation

Research and technological innovation have contributed in an indispensible way to the current state of development of the Community's iron and steel industry. To maintain the advanced and competitive position of the industry in a society committed to sustaining its standard of living, there will be a continuing requirement for technological progress aimed at improving production processes and products.

Future research policy will be dictated by the evolving needs of the industry which is heavily dependent on external supplies of iron ore and of fuel (particularly oil). World developments in the pattern of steel production together with the increasingly competitive nature of international trade will also influence the direction in which technological advance is sought by steel producers and steel users alike.

Priority areas for research and development effort over the next decade or so will include:

1. Quality of steel products — directed at making steels of better and more consistent quality and embraces most aspects of steelmaking, casting and subsequent processing.
2. Energy conservation and energy substitution.
3. Improvement of conventional production routes and the investigation of new processes.
4. Recovery and recycling of raw materials and waste products in so far as it does not already occur.
5. Environmental protection.
6. Fabrication techniques — particularly in relation to welding procedures and the resulting properties of welded components.
7. Improved understanding of the service performance of steels in relation to their properties — including large scale testing of fabricated components.
8. Corrosion, stress-corrosion and corrosion protection.
9. Non-destructive testing techniques for improved product control during manufacture and to extend service life of fabricated parts.
10. Utilization of steels — including industrialized building and exploitation of steel in marine technology.

It is envisaged that these goals will be achieved primarily through the further development of existing technology with an inevitable increase in sophistication of production and processing methods and techniques.

The Commission will continue to play a valuable role in the promotion of research and development in the steel industry through Article 55 of the ECSC Treaty. An important aspect in the development of this cooperative programme is the greater emphasis being placed on the selection of research priorities so that industry can derive the maximum benefit from the available resources. The need for a greater concentration of effort in this ECSC research and a reduction in the number of research contracts (now over 150) will also be aided by these activities. This will mean more emphasis on large-scale effort but not to the exclusion of the smaller projects which are necessary in certain areas. What the Commission aims to achieve is a better equilibrium between large and small projects than exists at the present time.

In the identification and selection of projects, more attention must be paid to the economic implications of research and some form of 'cost-benefit' analysis will become an increasingly necessary criterion in the assessment of proposals. This stems from the increasing pressures on industry to reduce costs and the potential that technical innovation has to help in achieving such reductions. Furthermore, the growing complexity of research in some key areas will necessitate preliminary studies (or surveys) being supported before a decision to embark upon a costly programme of research is considered.

Steps are now being taken to initiate such a preparatory study in the field of blast-furnace coke following the first meeting of the ECSC Coke Research Contact Committee held earlier in the year.

The ECSC programme, which is concerned with important collective needs of the industry, represents a relatively small part (5 to 10 %) of the total research in progress on iron and steel within the Community. The main bulk of this activity is planned and carried out by the industry (within its research laboratories) and by the cooperative research institutes which together represent extensive resources both in expertise and in experimental facilities. The continued effective utilization of these resources will depend on the correct choice of research topics, on the timing of research in relation to market needs and on the ability to translate technological progress into process or product innovation.

In the future development of this research effort, it is seen that there will be an increasing need for the steel producers, workers and users to collaborate more closely so that each fully understands and appreciates each others technical and economic possibilities and limitations. This close coordination, not always evident in the past, is essential if product-oriented research is to be effective and lead to successful technological innovation and new markets for steel.

In addition, industry needs to ensure that the advanced state of technology and the 'know-how' available within the Community is rigorously exploited and subsequently reflected in the quality and technological sophistication of its steel products. Sometimes there are difficulties in achieving this important objective which may be due, for example, to the lack of appropriate plant and equipment (size, capacity, etc.) to apply the new process or to manufacture the new product. It is essential at the planning stage of research, therefore, to consider possible barriers that might be met in the future application of the results to existing production plant and conditions. In this way completed research work should not be hindered in its further development at the commercial application stage.

Finally, it is envisaged that research over the next decade will be concerned primarily with increasing the productivity and reducing the operating costs of existing processes together with improving the quality of existing products. Advance will be, for the most part, gradual with progress being achieved through the development of existing technologies.

Employment

The labour problem was studied by analysing work force trends (workers and staff) in the Community countries and in certain regions.

An historical analysis of the period 1965 to 1973 shows that the total work force in the Community as originally constituted remained constant between these years. An examination of the situation in different countries indicates that the work force declined by 23 000 in Germany and 3 500 in France while it increased in the other countries, especially Italy (by almost 30 %). The regions which showed the greatest increase in employment were the coastal areas (north and south of the continent) while the largest reductions in employment occurred in North Rhine-Westphalia and eastern France. The lack of comparable statistics made it impossible to analyse the employment situation for the three new member countries.

Forecasts of the work force in the Community steel industry in 1980 were prepared on the basis of probable trends in steel production, productivity and actual working hours.

Development trends for the three factors on which manning estimates are based were calculated as follows:

— for production, on the basis of expected changes in steel consumption, exports and production potential,

— for productivity, on the basis of an analysis of past trends, investment plans and the resultant changes in production plant,

— for actual working hours, on the assumption of cuts of nought to three hours in actual working week compared with 1973, depending on how favourable economic conditions are in 1980.

A comparison of the work force in 1980 if market conditions are good — and in the case of a reduction of the actual working week by one hour — with the situation in 1973 shows that there will be a reduction of 28 000 in the period considered for the whole of the Community as originally constituted. Assuming poor market conditions in 1980, 32 000 jobs could be lost with a reduction in the actual working week of three hours. If one adds jobs lost in the British Steel Corporation one arrives at total reductions of more than 54-58 000 for the enlarged Community, according to market conditions (1). In many cases it should be possible to keep reductions within acceptable limits through natural wastage, but a corresponding reduction in the number of work places available is of course implied.

Regional manning trends indicate that the movements already noted in 1965 to 1973 will continue. The greatest reductions in the work force will be found in eastern France, eastern Belgium and North Rhine-Westphalia — several thousand people between 1973 and 1980. On the other hand the number of persons employed is expected to increase in the southern coastal regions and to a lesser degree in northern France. Manning data for British Steel Corporation indicate that a significant reduction of the work force will take place between 1973 and 1980 in several regions.

Employment forecasts for the steel industry in 1980 indicate that in some countries and especially certain regions there are likely to be human problems. Consideration must be given to all the consequences that a large reduction in employment entails in addition to the loss of jobs — for example the worker will either have to retrain to obtain different type of job or continue in his existing occupation after moving to another region with a radical change in his habits and way of life.

The estimated cut in the Community steel industry's work force is therefore a serious human problem. On the other hand, if it is to remain competitive the steel industry is compelled to take rationalization measures and these must embrace manning. If the current level of employment were to be maintained, the industry's competitive strength would be undermined and redundancies would eventually become inevitable as marketable output declined. The social and regional policy should therefore aim to facilitate the necessary adjustment to structural changes rather than to preserve an outmoded employment level. This does not of course preclude measures to avoid sudden mass redundancies. By spreading redundancies more evenly over a longer period, it will be possible to avoid serious disturbances on the labour market with all the economic and social consequences they would bring with them. To this end long-range personnel planning by the enterprises can make a useful contribution.

A prerequisite for a successful social policy is agreement amongst all concerned on the employment targets to be attained. Consequently the Commission, in cooperation with all the interested parties, has prepared the above forecasts on the basis of the production objectives for 1980 outlined earlier.

As with all forecasts, there is a degree of uncertainty, and the results cannot be considered as an accurate prediction but are merely intended to give orders of magnitude. They should provide guidance for workers, employers and governments on future structural changes in the demand for labour in different countries and regions, so that measures can be taken in good time by all those involved. Redundant workers can be re-employed either in other jobs in the steel industry itself or in different sectors. It is therefore necessary to create new jobs and where appropriate to retrain workers who lose their jobs. Article 56 of the ECSC Treaty gives the Commission powers in both these areas, and it has made use of them in many cases. Further in a specified case social aid has been provided under Article 95 (1) of the ECSC Treaty. The European Social Fund also has a role to play here.

These measures call for a readiness on the part of workers to change their occupation and possibly to move their homes. As future economic growth will, to a greater degree than in the past, be accompanied by structural adjustments to new production techniques and to changes in demand or in the international division of labour, it is necessary to promote greater mobility not only of capital but also of labour. The principle to be adopted should be that society as a whole must bear the financial burden of adaptation and not the indnvidual.

(1) For Great Britain, Denmark and Ireland, due to absence of data no estimates were made by the Commission. The data from a British Steel Corporation study was used here.

In the past a number of measures have been taken to improve and facilitate mobility of labour, such as the construction of housing in the new coastal steel centres, but in future the continuing structural changes on the labour market will make mobility of labour even more important and regional policy will also have a part to play in order to avoid geographical imbalances.

Training is another no less important task. As already stated, the Community is poor in energy and raw materials, but in comparison to many countries has a rich reserve of highly qualified personnel, this term being taken to embrace all groups from the skilled worker to the engineer and scientist. To gain maximum benefit from this asset and offset the disadvantage of relatively high energy and material costs, it is important to make every effort to improve the level of training and adapt it to constantly changing and ever more complicated techniques of the iron and steel industry.

For the proper implementation of those measures, it is essential to have a policy that goes beyond a mere employment relationship and gives the workers and their representatives the opportunity to take an effective part in all decisions affecting their jobs or the future development of the company and its work force. General prosperity in the Community depends very much on a continuing improvement in the quality of work and the sense of responsibility of all those involved — employers and workers.

In addition to the aims regarding mobility of labour and the quality of work in the widest possible sense, the question of making working conditions more human must also be considered. This covers aspects such as the improvement of industrial hygiene and medicine, industrial safety and the adaptation of work processes to the physical and mental requirements of the human individual.

As already pointed out, because trade cycles are increasingly tending to take a parallel course in the major world trading countries, cyclical fluctuations appear to be growing stronger. This could result in large short-lived fluctuations in labour demand in the steel industry, with excessive requirements in boom periods and slashing cuts in recessions. Apart from the fact that economic policy should help to avoid excessive cyclical fluctuations, it will be important for public authorities and companies to take measures designed to mitigate the social consequences. These should take the form not only of financial aid for those affected but also of measures to avoid sudden mass redundancies such as the introduction of short-time working or the temporary closing down of works for the main holiday period, as already done in 1975.

These general lines will suffice here, leaving as in other fields, the working out of details and the proposal of the necessary concrete measures to specialized studies.

Social research

All technical progress depends for success on being introduced to the employees under acceptable conditions.

To this end it is above all essential for technical research to take into consideration simultaneously the quality of the product, the process of manufacture in all its aspects: speed, ease of operation, dependability and so on, and the effects of the process on the working environment. It is similarly necessary that certain problems of hygiene and safety should be tackled and resolved, using all the resources of biology, engineering, organizational and environmental sciences — which is the specific task of social research. The aim of this is to improve the means available to the enterprises and the social partners for avoiding the risks of sickness and accident and to improve welfare and work-satisfaction. The constant concern of the Community is accordingly to steer research in the direction of the real needs and the problems experienced by enterprises. The Commission is currently drawing up guidelines for ECSC social research for the period 1975 to 1980.

Regional policy

In most cases the iron and steel industry has a considerable influence on the economy of the region in which it is situated — above all if it is an industry of long standing. Consequently changes in the iron and steel industry have important economic effects which cannot be determined in examining the industry in isolation.

The four main links between the steel industry and the local economy are the demand for local natural resources, the creation of direct and indirect employment opportunities, the supply of steel products to local industries and the environmental consequences of the industries' activities.

The forecasts of employment levels which have been undertaken for the steel industry of a number of regions indicate that total employment in the industry will continue to decline in spite of increased production and that there will be substantial variations from one region to another. In some cases the regions concerned are already suffering from poor economic prospects and high rates of unemployment. This means that we have to deal with the general lines of development and reconversion policy.

Regional policy is concerned with correcting economic imbalances and consequently may be applied in regions where the steel industry is creating economic or social problems. For example:

— by financing new installations in development regions, taking account of overall capacity,

— by financing modernization and expansion of existing enterprises to improve productivity and to maintain employment whenever possible,

and

— by financing programmes of industrial reconversion to create new and economically viable activities which would be capable of re-employing labour released by the steel industry.

Redevelopment policies affect both the steel industry itself and the economy of the steel producing areas. The effect of a reduction in employment due to increasing productivity in an existing plant is less grave than an equivalent reduction in employment due to a closure because in the first case there is the possibility of internal reassignment of workers and because many indirect links between the industry and the region remain intact.

National and Community authorities consequently have to take account of the alternative economic possibilities of the regions concerned and will adopt development and reconversion policies accordingly, to facilitate necessary new investments both by ensuring that modernization programmes within the industry are promptly executed so that the productivity and competitiveness of the affected regions' steel industries be guaranteed, and by adapting reconversion policies to replace economic activity and employment opportunities in those regions which will suffer reduction of job opportunities in their steel industries.

Such policies can only be implemented over a period of time, and with careful preparation. In these circumstances, the determination of priorities for redevelopment must take account of the relative strength of the economy of the regions concerned. The economic and social significance of a decline in production and employment in the steel industry depends on the degree of regional dependance on the steel industry and whether the sound development of alternative economic activities is possible. From this point of view, the decline in employment anticipated in eastern France, eastern Belgium, Scotland and Wales is disquieting unless effective regional measures can be implemented. Article 56 of the ECSC Treaty is available in such circumstances but other resources should also as far as possible be used.

At the Community level, the main instruments of development and reconversion are Articles 56 and 54 of the ECSC Treaty, the European Regional Development Fund and the European Investment Bank.

— Article 56 of the ECSC Treaty allows the Commission to make loans on favourable conditions for the expansion or creation of new activities in the coalmining and steel industry as well as in all other industries in regions experiencing employment problems resulting from changes in the coal and steel industries.

— Article 54 of the ECSC Treaty permits the Commission to facilitate the financing of construction, expansion or modernization of steel plants.

— The European Regional Development Fund may participate through capital grants in the financing of investments in the eligible regions.

— The European Investment Bank may participate in regional development, applying Article 130 (a) of the EEC Treaty.

As already stated, Article 56 of the ECSC Treaty contains the principles of reconversion giving the Commission powers of financing interventions in regions where coal or steel enterprises create employment problems. In this case the Community can make loans to companies which expand or set up in these regions. It may also participate in financing the promotion of industrial estates directly related to the creation of new jobs. The companies which benefit thereby agree to give priority to recruiting ex-ECSC workers.

For each request for reconversion, the Commission satisfies itself that the potential re-employment proposed by the enterprise is acceptable in terms of the numbers of coal and steel workers coming on to the labour market and in terms of the technology and location of the project, and the training facilities provided. The market prospects and financial return from the investment are also examined in order to ensure that the project will make a permanent contribution to the redevelopment of the region.

From the point of view of the redevelopment of the economy of the region, the main considerations are the effect of the project on the diversification and strengthening of the economic structure, and the overall employment effects, including indirect effects. However, it is important to establish that a reasonable proportion of new jobs created will be reserved for ex-ECSC workers.

There are no formal restrictions on the regions which may be aided under Article 56 of the ECSC Treaty.

Thus, there are no limits to the kinds of activities which can be assisted to redevelop these regions. In practice, the beneficiaries are normally manufacturing concerns which can be attracted to areas which are already highly industrialized and which are able to re-employ coal and steel workers, but appropriate activities in services or infrastructure cannot be excluded.

In conclusion, strategy for implementation of the general objectives for the steel industry should be influenced by the following regional considerations:

(a) the vulnerability of the regional economy to additional redundancies or short-time working resulting from planned reductions in output;

(b) the capacity and location of new plant within the Community should take account of the economic situation in each of the regions concerned;

(c) in those regions where the restructuring and modernization of the steel industry results in permanent and substantial loss of job opportunities, reconversion policies will give priority to the redevelopment of the affected regions. The Community has available sound and flexible instruments for this purpose. The financial resources available to facilitate Article 56 of the ECSC Treaty loans for reconversion should, as far as possible, be adapted to the necessities, so that necessary modernization of the steel industry should not be prejudiced by lack of alternative employment opportunities for the people concerned.

While priority must be given to the re-employment of the people directly affected by closure, resources must be made available to finance the replacement of job opportunities in the regional economy, as a whole.

Raw materials

On the basis of crude steel production forecasts broken down by steelmaking method, pig iron requirements can be estimated at 118·5 million metric tons under average conditions and 129·1 million metric tons for the upper limit in 1980, against 106·8 million metric tons in 1973. The pig-iron/steel ratio will drop from 71·1 % in 1973 to 69·6 and 70·5 % respectively in 1980.

The production of foundry pig iron is in a period of recession in the face of temporary imports at extremely low prices. For reasons of security of supply both quantitative and qualitative the production of foundry pig iron within the Community makes an important contribution to the supply of needs.

Total iron ore consumption in the Community steel industry in 1980 should be between 106 and 116 million metric tons Fe content depending on market conditions, with 19 million metric tons coming from Community deposits.

Total scrap requirements would be 77·1 million metric tons for average conditions and 81·5 million metric tons for the upper limit, compared with 67·4 million metric tons in 1973. Allowing for estimated resources, including 2 million metric tons of prereduced ore, net imports of scrap would be 1·2 million metric tons compared with 1·0 and 1·1 million metric tons in 1973 and 1974. The assumptions concerning specific consumption of scrap on which these estimates are based correspond to actual figures for 1973 and 1974. An additional assumption corresponding to an increase of 10 kg in specific consumption for oxygen steelmaking methods has been introduced; this gives a total requirements of 78·3 to 82·8 million metric tons and net imports of 2·4 to 2·5 million metric tons. These estimates of growing needs for scrap imply a price rise under average market conditions and a more marked rise if the upper market limit is reached which is an essential condition for a sufficient scrap collection.

Requirements for alloying elements should increase up to 1980 more rapidly than in the past since the share of special alloy steels in total crude steel output will in 1980 be 9·5 % against 7·4 % in 1972.

Energy requirements for the steel industry have been estimated in terms of coal equivalent at 137·2 million metric tons and 147·5 million metric tons for the average trend and upper limit respectively, against 123·7 million metric tons in 1973. Generally speaking, fuel oil and above all electricity consumption should record the greatest increases.

The main problems arising in connection with raw materials supplies are analysed below.

A — *Iron ore, manganese ore and alloying elements*

For its mineral raw materials for use in the steel industry, the Community is a net importer. Its degree of dependence on imports is about 80 % for iron ore in terms of Fe content and rises as high as 100 % for most alloying elements.

This increasing dependence on non-member countries, which is equally evident in sectors other than the steel industry, has prompted the Commission to prepare proposals for the coordination of efforts and if necessary the implementation of joint action to ensure Community supplies.

It should be possible to fit the supply policy for raw materials for steelmaking into this more general framework in so far as the solutions to be found are often common to all sectors.

As part of its raw materials policy, the Commission will urge that thought be given to ways of ensuring that Community iron ore mines remain open in the long term, and how recuperation of alloying elements can be effected.

At world level, there seems to be very little risk of absolute shortages for almost all minerals. The main raw material supply problems result from the lack of diversification of sources of supply, the difficulty in finding the enormous amounts of capital required to increase capacities or the risks of temporary bottlenecks and price fluctuations.

The Community steel industry's dependence on imports from non-member countries tends to increase in parallel with the development of its steel output while the geographical location of the known reserves limits its suppliers to a very small number of countries, with the exception of iron ore and nickel. The dominant position of one of these countries exposes the Community to the risk of having to accept supply conditions in which quantities and prices will be difficult to negotiate.

At least a partial solution could be found to the spreading of risks and the dangers of shortages if the Community steel industry were rapidly to decide to carry out mining projects by participating financially in one way or another in the setting up of production and processing plant in non-member countries or by indicating its intention of purchasing relatively large quantities of ore from deposits to be opened up and later committing itself to such purchases.

An improvement in the conditions of supply of raw materials is also to be aimed at through strengthening ties between the iron and steel industries and the non-member countries mining undertakings.

The security of supply of the iron and steel industries must be a question of orientating towards the newly industrializing and the developing countries who are raw materials suppliers with due regard for what is most economic and the facts of the situation.

The Commission regards itself as obliged to accord special assistance to the developing countries as part of its overall policy, while preserving the competitiveness of its own industry. The steps taken to assure the security of supply of raw materials cannot therefore be limited to negotiations with the developing countries.

The emerging trend for developing countries to upgrade their own raw materials in order to contribute to their economic and social development makes it necessary to find ways and means of reconciling the interests of producing and consuming countries.

To this end the Commission could conclude outline agreements to equalize interests whereby the Community countries would supply investment capital and technology while the developing countries would guarantee the supply of raw material to the Community. The Community could furthermore take other measures to stimulate investments in the developing countries and guard against risks in particular by:

— subsidizing exploration activity in the widest sense,

— facilitation of credit for investments,

— improvements and widening of insurance against risks entailed in foreign investment,

— financial aids for infrastructures.

It should be emphasized that, pursuant to Article 54 of the ECSC Treaty, the Commission may facilitate the carrying out of investment programmes in non-member countries by granting loans to undertakings or by giving guarantees. The Commission has already acted in this way by granting Community undertakings loans to help secure their raw material supplies.

Some minerals give greater cause for concern than others.

Although iron ore reserves are fully sufficient, difficulties could arise if mining capacities were insufficiently expanded because of the enormous capital requirements and limited profitability. The Community steel industry is participating within the limits of its financial and contractual means in foreign iron mines and their development, but additional measures are necessary to obtain security of supply.

World reserves of manganese ore and alloying elements appear in general to be adequate to meet demand. However, the fact that there is often only a very small number of supplier countries, some of which may pose political problems, is likely to create supply difficulties now and again for some products.

For these reasons, measures that relate solely to investment for the development of mining capacities and the production of raw materials are not sufficient; they must also help to boost scientific and geological research on the deposits and prospecting all over the world in order to find new sources of ore.

B — *Scrap*

Contrary to the position for mineral raw materials, the industrialized countries are both the main producers and the main consumers of scrap. The external market only deals in marginal quantities, but these have a disproportionate influence on the total balance.

Several courses of action concerning the internal market appear essential.

To increase the share of light capital scrap in total resources it is necessary to step up investment in plant for handling this type of scrap. Special attention should be paid to the location of these installations to prevent the geographical concentration already noted (especially for shredders) from becoming excessive.

For exports to non-member countries, there is no reason to change the policy followed to date; the Community will for many years to come remain a net importer. The ban on exports should be maintained during the period covered by these General Objectives, but some export quotas should be granted the trade in periods when internal demand is low, to enable it to operate to a certain extent and to give it the incentive to carry out necessary investments. On the other hand these quotas should not be too large, so as to avoid the flow of scrap reserves to non-member countries during recessions and the consequent non availability of the necessary reserves in the Community at times of high economic activity.

Problems concerning imports from non-member countries, especially the United States, should be resolved by regular contact between the Commission and the countries concerned.

If specific scrap consumption were to exceed the estimated lower limit in 1980, which is technically quite feasible, there would undoubtedly be serious supply problems, particularly as some of the current supplier countries may well cut their exports substantially in 1980 in order to cope with the increase in their own crude steel output from electric steelworks. What is more, the lower limit can easily be attained, as it is based on scrap consumption in 1973 and 1974. Consequently the quantitative balance on the scrap market depends in periods of boom not only on commercial policy but also on an increase in the price of scrap to a level such that the steel industry must adapt the scrap inputs to the 1973 and 1974 levels.

C — *Sponge iron*

Up to 1980, only relatively small quantities of sponge iron will be used in the Community steel industry, but it should help to cover some of the scrap requirements, and this will have some influence on the scrap market. Availabilities on the Community market are estimated at two million metric tons for 1980.

Sponge iron is at present best suited to use on the spot as its carriage still raises problems. Research on these lines could be of great benefit for the future supply of prereduced ores.

D — *Energy*

The steel industry's coking coal requirements will increase only very slowly in the medium and long term. The small increase in demand should be met as Community production covers most of the requirements so long as long term contracts between producers and users of coal exist which justify on the one hand investments necessary to maintain capacities of production and, on the other, the continuance in service of almost all the coking plants. It is true that due to the different stages of development of works in certain regions there will be a slight reduction in the extraction of coking coal in the Community. Furthermore one must take account of the requirements for coke outside the iron and steel industry, which are going to diminish in the long term. Should the occasion arise the Commission will facilitate the extension of loans for purposes of investment designed to augment the supply of coke on the market. Conditions of supply from non-member countries will be improved by the participation of some Community enterprises in mining undertakings of these countries and by long-term delivery contracts. It is the intention of the Commission to harmonize coal import policies.

In respect of fuel oil a certain number of factors give the estimates relating to supply an uncertain character. The question of quantity poses a lesser problem than that of price. The development of new sources of supply, particularly in the North Sea, will entail some changes in the structure of the petroleum products available. As regards natural gas there will be a growth in supply owing to the exploitation of new deposits. A number of users, among which is the iron and steel industry, are continuing to increase their demand for natural gas. From the point of view of the quality of the environment the use of this form of energy is desirable.

As to electricity, inflation, rising capital costs and fuel oil price trends are reflected in electricity costs; the growing share of nuclear power in electricity production should improve the supply conditions for this type of energy provided the necessary investments are realized in time. Despite the research in progress, no specific application of nuclear energy in the steel industry can be expected in the years covered by these General Objectives. Integrated nuclear steelmaking involves processes that are as yet insufficiently investigated and too uncertain. In the longer term, however, the development of the nuclear industry will undoubtedly have a profound influence on the use of energy and the production of finished products in the iron and steel industry.

Competition

There have been several developments in this field since the Commission published its competition policy guidelines for the iron and steel industry in 1970 (1).

The entry of the British Steel Corporation (BSC) into the common market in steel has considerably modified the size relationships between Community steel companies. With an annual capacity of *c.* 25 million metric tons of crude steel in 1975 BSC is the biggest steelmaker in the enlarged Community. The very size of BSC with its dominant position in the United Kingdom market have caused the Commission to pay particular attention to the possible effects of mergers and cooperation agreements there (2).

There is still a continuing trend towards larger production units, often joint ventures set up on the coast. This reorganization process is intended to bring about scale economies as a result of the increased production capacity of modern plant. The level of investment involved and the need for optimum utilization of new capacity has encouraged firms to cooperate.

Such cooperation arrangements and the joint ventures emerging from them, make it difficult to maintain effective competition in this industry. The more powerful the groups and the smaller their number, the more active the Commission must be in taking appropriate measures to ensure mutual independence and non-interference in the affairs of other groups. It must also take into account the effect of imports on competition.

In addition to the normal measures to ensure the autonomy of large firms or groups (e.g. the prohibition of corporate interlocks and the maintenance of independent sales networks), the Commission has on several occasions authorized large-scale mergers provided that the firms concerned sold any financial holding linking them too closely to other competing steel firms (e.g. the reduction of Thyssen's holding in Mannesmannröhren-Werke to 25 % so as to eliminate its blocking minority when the Thyssen/Rheinstahl merger was approved; reduction in Schneider's holdings in Marine/Wendel to 10 % after the CLIF/Marine merger). Similarly, the Commission approved major mergers (Thyssen/Rheinstahl, Krupp/Südwestfalen, CLIF/Marine) on the condition that the firms concerned obtain prior

(1) OJ No C 12, 30. 1. 1970, p. 15

(2) Because of its dominant position in a substantial portion of the common market the BSC is, in case of an abuse, subject to the conditions of Article 66 (7).

authorization for any proposal to acquire non-controlling holding of 10 % or more in steelmakers, distributors or large-scale users.

In the case of Solmer, set up by three major groups, the Commission took account of the fact that Solmer was a production cooperative which supplied its shareholders at cost in quantities proportional to their financial participation. The three member groups processed most of the coil which they received from Solmer in their own plant and sold the finished products through their own sales networks. Solmer did not sell products to final consumers at all.

Also, the three groups were to continue to manufacture themselves as well most of the types of product supplied by Solmer. Consequently they were dependent on Solmer only to a limited degree and would compete with one another on the market in the whole range of products.

There is also a noticeable tendency for firms to diversify into types of production not covered by the Treaty in an attempt to increase their profitability and at the same time reduce the risks inherent in single-product operation on a market subject to sharp fluctuations in demand. The Commission has authorized two major mergers of this type: Mannesmann/Demag and Thyssen/Rheinstahl.

These developments have led the Commission to examine such cases in the light not only of Article 66 of the ECSC Treaty but also of Article 86 of the EEC Treaty. The Commission must decide whether the financial strength and degree of diversification and self-sufficiency of the merging firms has placed them in a position to pursue strategies independent of market forces and thus evade the competition rules laid down in the two Treaties.

The continuing process of concentration in the industry has made the Commission more critical in its attitude towards cooperation agreements, as defined in Article 65 between large producers since these might compromise their independence. Thus as successors to the German joint selling agencies it only authorized four specialization agreements (Rationalisierungsgruppen).

This change increased the number of German suppliers. In authorizing the Thyssen/Rheinstahl merger it compelled Thyssen and Rheinstahl to withdraw from the West and Westphalia rationalization groups, since their participation in two competing organizations might have eliminated normal competition between the large groups.

The increase in concentration on the production side — for both ordinary and special steels — has focused the Commission's attention more closely on distribution, the purpose of which should be to offer the consumer a genuine choice of products at competitive prices. The fewer the manufacturers and the larger their share of production, the more important the role of distribution. It is essential that a sufficiently large number of stockholders should remain financially independent of the manufacturers in order to maintain intra-Community trade and competition. Accordingly the Commission has authorized mergers and cooperation agreements between stockholders to enable them to improve their hold on Community markets.

In general it can be said that the main structural development in the Community's iron and steel industry in recent years has been increasing concentration among the large companies together with a proliferation of large and small-scale joint ventures. The elements of competition policy to be found in the publications mentioned above will also serve as guidelines in the future. The Commission, in taking into consideration that the Community steel industry is passing through a significant crisis, is examining to what extent the competition policy of the Commission could be adapted in relation to the guidelines of 1970.

The role of the Commission in overseeing and checking State aids in accordance with Articles 4 (c) and 67 of the ECSC Treaty is of particular importance. The Commission will make use of all the means put at its disposal by the ECSC Treaty to ensure that the aids do not violate the rules of competition. To this end close cooperation between the Governments and the Commission is necessary.

Protection of the environment

The size of iron and steel plants and their unit production capacity will continue to cause problems because of the geographical concentration of pollutant emission. Owing to the scale on which dust, gas and heat is emitted, this concentration has a variety of consequences for man and the environment. The legislative action that has been, or will be, taken to reduce it is liable to limit the size of the production units unless research is carried out with the aim of making the impact of these emissions tolerable from the environmental standpoint.

In the General Objectives a growth of output in the Community is foreseen for the years 1980 to 1985. This increase can only be achieved by enlarging the capacities of existing works or by erecting new iron and steel production facilities. The latter will have to meet special requirements with respect to site protection, tourist amenities and water purity. Moreover, the siting in urban areas of mini-works using primarily steel production techniques will give rise to pollution problems that will be all the harder to solve in view of the risks to which the urban environment is already exposed from other quarters.

Against this can be set the fact that the processes used in the fabrication of crude steel are undergoing gradual transformation. By 1980, the highly pollutant basic Bessemer processes will have been virtually superseded by electrical or oxygen-based processes, whilst a significant decline in the utilization of the open-hearth process is foreseen.

During the next decade, however, the measures employed to combat pollution will have to become more and more stringent, especially in areas with a heavy concentration of industry.

The measures taken will be heavily influenced by two factors:

— the trend towards the recycling of water and recoverable wastes,

— the modernization of manufacturing processes, which makes it easier to implement measures to combat pollution.

Great efforts have already been made in a number of countries and in particular where the Member States in the Community have availed themselves of certain facilities offered by the ECSC Treaty (Articles 54 and 56 on investments and Article 55 on research) as well as the European Investment Bank.

Furthermore, provision has been made in the Community's environment programme, which was approved by the Council in November 1973, for the study of problems arising in certain branches of industry, one of which is iron and steel, as a result of the policy of pollution control.

The projects launched by the Community under this programme, which are bound to affect directly the evolution of activities in the steel sector, tackle the problem from three angles:

(a) Objective evaluation of the hazards to human health and the environment from pollution. Within a short time the Community expects to have defined these risks with respect to air pollutants (notably SO_2 and suspended particulate matter), water pollutants and noise nuisances;

(b) Protection of natural surroundings (water, air and soil).

The research on the protection of the quality of water will be completed in 1980 with a Community definition of quality objectives for water corresponding to its various uses and functions [1].

By the end of 1980, draft Directives will have been presented to the Council on air quality standards with respect to the level of carbon monoxide, sulphur dioxide and suspended particulate matter, as well as other air pollutants.

Finally, soil protection is being dealt with by projects relating to wastes and residues. A Directive on waste was adopted by the Council on 15 July 1975. The Commission is also preparing a Directive on the storage, transport and treatment of toxic waste, and has had studies carried out on bulky ferrous residues in the general context of the scrap metal market.

In the years ahead, when the results of these studies have been processed, the Commission will present whatever proposals may seem appropriate.

The effect of this package of general measures will be to make the iron and steel industry give due weight to environmental objectives:

— either by giving preference to the least pollutant techniques of steel fabrication, and in some cases replacing factories where de-pollution would involve costs incompatible with profitability,

— or by increasing anti-pollution investment in some branches of the iron and steel industry, and providing effective means of countering pollution when new factories are erected;

(c) A sectoral approach to the problem, based on a proposal from the Commission, should result in further measures being taken by the Member States to bring about a specific reduction in the various forms of pollution, caused by particular industries, according to a proposed time schedule; these measures would have to take account of the location of the undertakings concerned, the cost of the measures and their economic, financial, commercial and social consequences.

(1) Drinking water, bathing water and water for agricultural, piscicultural and industrial uses.

The aim of all these projects is to set certain objectives and draw up a programme by which they can be progressively implemented.

Environmental research in the steel industry

The first research financed by the ECSC under Article 55 of the Paris Treaty into the control of pollution by the steel industry started in 1957. The work in those days concentrated on the protection of workers at their place of work.

About that time the emergence of the new oxygen steelmaking techniques necessitated the financing of ECSC research in order to develop methods of reducing brown fume from the converters.

This research programme was far wider in scope than the previous one, and it was acknowledged that it would enable the steel industry to cope with the air-pollution problems for which it was responsible in its immediate environment.

Most of the work was devoted to ways and means of controlling the emission of air pollutants by various activities in the steel industry, although basic research into the physics and nature of the pollutants was not neglected.

New pollution control problems in the steel industry are covered in the third programme on 'Technical control of pollution in the iron and steel industry' (1).

This research programme, unlike the preceding one, covers not only air pollution but also pollution by waste waters and noise problems.

The broadening of the programme to include liquid effluent is justified by the fact that when waste gases are scrubbed, the solid particles removed from the gas are very often met again in the form of sludge. This is tantamount to a 'transfer' of pollution. Waste waters should therefore be treated by mechanical, chemical, physical or biological methods before being discharged or recycled.

It also appeared necessary in this programme to tackle the question of waste from steelmaking and the efficient disposal of residues from the purification of polluted gases and waste waters.

Noise abatement measures should first and foremost be aimed at the development of less noisy manufacturing processes so as to reduce noise generation at the source. Only where noise cannot be reduced at source will it be necessary to adopt the often expensive measure of insulating the noise source from its surroundings.

In many jobs a certain degree of air pollution by dust, smoke, fumes and gases will be almost inevitable. It will then be necessary to encourage research to facilitate assessment of the health hazards this emission involves and to find ways and means of reducing these hazards, either by replacing noxious substances by non-dangerous, or at least much less dangerous, substances in the manufacturing process or by devising suitable methods of individual protection.

The research programme must take full account not only of present but also of foreseeable future production techniques.

It provides for projects in the following fields:

Coke ovens: collection of fumes during the discharging of coke; treatment of waste water from coking plants.

Pig-iron production:

Modern sinter plants are provided with anti-pollution equipment when constructed. However the use of different fuels and the charging of imported ores pose unresolved problems regarding the quantity and nature of the dust emitted and the noxious waste gases released.

Pollution problems in the blast furnace appeared to have been satisfactorily solved a long time ago.

However, pollution during the tapping of blast furnaces will have to be eliminated, attention being paid to factors such as the increase of production, size of installations and composition of the burden.

Steel works:

LD, LDAC, OLP and Kaldo works:

Progress has been made in the elimination of brown fume from oxygen converters in the past decade owing to the development of various processes which work satisfactorily in practice with regard to the purification standards laid down.

(1) OJ No C 92, 6. 8. 1974.

However, industry will continue to seek smaller devices that are cheaper to install and maintain and are more reliable in operation.

Basic Bessemer and OBM/LWS works:

Some of the problems mentioned above for the production of top-blown steel are applicable to bottom-blown converters. While it is perhaps superfluous to research into solutions for the conventional basic Bessemer process because of its rapid decline, it is still advisable to examine the cases of the Oxygen-Bodenblas-Metallurgie and Loire-Wendel-Sprung processes.

Electric furnaces:

With the increase in the capacity of electric furnaces, there will be problems of industrial health in melting shops and of environmental protection which have been tackled only sporadically in previous research programmes.

Rolling mills:

Rolling mills have not played an important role in air pollution. However, soaking pits, reheating furnaces, flame scarfing and ingot grinding can be sources of gas, dust, noise or fume emission calling for preventive measures.

The consideration of water pollution, the trend towards products requiring more processing and the surface treatment of products raise questions to be put to research workers.

Under the heading of general problems, the programme groups together subjects of concern such as:

— reduction of pollution caused by materials handling,

— treatment or re-use of residual matter from iron and steel production and from air and water cleaning plant,

— prevention of dangers caused by inhaling gases or dusts, e.g. silicogenous dust occurring in the handling of certain refractory or abrasive materials.

For the fight against pollution to be efficient and respect ecological data, it is necessary to know the chemical and physical nature of the pollution and also its quantity and concentration at the work place and in air, water and soil. To this must be added a specific knowledge of the properties of pollutants likely to affect the environment, separately or in combination with other materials.

The measurement of pollution and a thorough knowledge of its effects on the environment and of the many inter-relationships between air and water pollution enable the main dangers to be recognized and priorities to be established in the fight against pollution. They also enable the technically and economically most appropriate methods of combating pollution to be selected and an objective evaluation of the results obtained to be made. The measurement of emissions is of great importance in the light of the use of new processes, especially in the field of further processing and with the much greater use to be made of recycling. The development of simple and reliable measuring devices and procedures adapted to practical conditions appears to be necessary in this field.

CHAPTER I

THE COMMUNITY STEEL MARKET

A — *HISTORICAL ANALYSIS*

The consumption of steel products in the Community in 1974 totalled 129 million metric tons of crude steel equivalent of products of the Treaty of Paris [1]. In comparison with 1965, the 1974 figure shows an increase in consumption of 31·1 million metric tons, i.e. 32 %. This corresponds to an annual growth rate of 3·1 % for the Community as a whole.

Such a comparison seems justified in view of the similar pattern of development of the steel situation in the two years in question. In most of the Community countries 1965 and 1974 were years in which internal consumption, after a period of intense growth, either slackened its growth rate or began to decline, with a resulting reversal of economic cycle on the steel market.

In the individual countries, the pace of growth of internal steel consumption varied in relation to the evolution, during the period under review, of the

(1) Except where otherwise indicated, the figures in this section refer to real steel consumption, derived from apparent consumption after correction for variations in processing industry stocks. Apparent consumption means apparent consumption by users obtained by adding together output, scrap consumption for re-rolling and imports, and then subtracting exports and correcting the result for variations in the stocks of steel producers and merchants.

main factors which condition the expansion of steel consumption and which will be discussed below.

Meanwhile, it can already be said that the countries in which the growth rate of consumption was strongest were Italy and Ireland, followed by France. The growth rate of consumption in the Benelux countries was also higher than the Community average, but only slightly. Germany and Denmark registered below-average consumption growth rates, while steel consumption in the United Kingdom was for well-known reasons lower in 1974 than in 1965.

Trend of real steel consumption in the Community countries (1)

Country	Steel consumption (million metric tons crude steel)			Average annual growth rate		
	1965	1970	1974	1965—70	1970—74	1965—74
Germany	34·2	42·4	44·1	+ 4·4	+ 1·0	+ 2·9
France	17·1	23·0	25·8	+ 6·2	+ 2·9	+ 4·7
Italy	13·6	20·0	23·8	+ 8·0	+ 4·5	+ 6·4
Netherlands	3·3	4·1	4·7	+ 4·6	+ 3·5	+ 4·0
BLEU	4·0	5·3	5·8	+ 5·4	+ 2·3	+ 4·2
United Kingdom	23·9	25·2	22·4	+ 1·1	— 2·7	— 0·7
Denmark	1·6	1·9	2·0	+ 3·5	+ 1·3	+ 2·3
Ireland	0·2	0·3	0·4	+ 8·8	+ 7·5	+ 8·2
Community	97·9	122·3	129·0	+ 4·5	+ 1·3	+ 3·1

(1) Uncorrected for continuous casting.

Steel consumption is closely related to general economic expansion, and particularly to the development of industrial production. The level of steel consumption and its rate of expansion are largely determined by:

(a) the general economic situation and its development in time;

(b) the pattern of economic expansion, i.e. the evolution of the main components of national income (mainly consumption and investment, but also exports, whose expansion — because of the importance of indirect steel exports — is partly reflected in internal steel consumption);

(c) the relative importance of the steel user sectors in the economic system and the development of their levels of activity;

(d) the levels of specific consumption of steel products in user sectors and its development as a result of various trends in substitution, reduction of weight, the introduction of new production techniques in the user sectors, etc.

The figures in the following tables show the differences between the level of consumption and economic development in the various countries, their trends between 1965 and 1974, and the varying rates at which they have attained their present levels.

Evolution of gross domestic product and steel consumption in the Community countries

(of Treaty products in million metric tons crude steel)

Country	GDP per capita (1)			Per capita steel consumption (kg)			Steel intensity (kg per Eur $)		
	1965	1970	1974	1965	1970	1974	1965	1970	1974
Germany	2·537	3·058	3·380	584	700	707	0·230	0·229	0·209
France	2·238	2·776	3·307	350	453	491	0·156	0·163	0·148
Italy	1·335	1·728	1·960	262	373	431	0·196	0·216	0·220
Netherlands	1·952	2·429	2·713	265	312	343	0·136	0·128	0·126
Belgium	2·114	2·628	3·090	412	526	573	0·193	0·199	0·185
Luxembourg	2·658	3·119	3·529						
United Kingdom	1·989	2·172	2·390	439	454	398	0·221	0·209	0·167
Denmark	2·640	3·160	3·562	335	385	395	0·127	0·122	0·111
Ireland	(1·088)	1·314	1·493	77	114	145	(0·071)	0·087	0·097
Community	2·037	2·454	2·776	402	486	499	0·197	0·198	0·180

(1) Gross domestic product at market prices per inhabitant, at 1970 prices and rates of exchange: 1 EUR = US \$ 1 in 1965 and 1970; in 1974 1 EUR = US \$ 1·25.

In particular, the consumption/GDP ratios (steel intensity) which are given in the final column of the above table, summarize the various structural and technological characteristics of the individual countries, since they reflect the differing importance of the steel user sectors in the various economies and give an indication of their respective rates of specific consumption (1).

The figures show that steel intensity varies among the countries of the Community.

In the light of these figures it is possible to interpret, although only partially, the elasticities (steel consumption/GDP) reported in the following table. Generally speaking it is acknowledged that the growth of consumption of steel is less in countries with a higher coefficient of steel intensity. The slacker development of consumption of steel is due to the fact that in such countries the position occupied by the iron and steel market is already relatively large. On the other hand the elasticity of steel consumption also tends to decline in relation to the level of national revenue; for higher levels of revenue the share of industrial production in the total revenue is always smaller and therefore steel requirements are relatively lower.

It may be concluded that the general trend towards the decline in the elasticity of steel consumption is more marked in the countries where steel consumption is highest (2).

(1) If U is used to denote the importance of the user sectors (expressed for instance by their added value), the intensity of steel consumption may be written $\frac{C}{R} = \frac{U}{R} \cdot \frac{C}{U}$ where C is the consumption of steel and R is the domestic product. This relation shows clearly that the intensity of steel consumption depends on the importance of the user sectors in relation to domestic product, and on their specific consumption.

(2) *Per capita* steel consumption depends on two factors already cited, i.e. the level of national revenue and the intensity of steel consumption, of which the effect in this case is to reduce elasticity. $\frac{C}{P} = \frac{R}{P} \cdot \frac{C}{R}$ where P represents the population, C and R represent consumption of steel and gross domestic product respectively.

Average annual rates of increase of gross domestic product per inhabitant, *per capita* steel consumption and average elasticity of consumption/GDP in the Community countries

Country	1965 to 1970			1965 to 1974		
	GDP	Consumption of steel	Elasticity	GDP	Consumption of steel	Elasticity
Germany	+ 3·8	+ 3·7	0·97	+ 3·2	+ 2·2	0·69
France	+ 4·4	+ 5·3	1·20	+ 4·4	+ 3·8	0·86
Italy	+ 5·3	+ 7·3	1·38	+ 4·4	+ 5·7	1·30
Netherlands	+ 4·5	+ 3·3	0·73	+ 3·7	+ 2·9	0·78
BLEU	+ 4·4	+ 5·0	1·14	+ 4·2	+ 3·7	0·88
United Kingdom	+ 1·8	+ 0·7	0·39	+ 2·1	— 1·0	— 0·48 (1)
Denmark	+ 3·7	+ 2·8	0·76	+ 3·4	+ 1·8	0·53
Ireland	+ 3·8	+ 8·2	2·15	+ 3·6	+ 7·3	2·03
Community	+ 3·8	+ 3·9	1·03	+ 3·5	+ 2·4	0·69

(1) Resulting from well-known factors.

Although the level of revenue has the effect of reducing the elasticity of consumption, the rate of expansion of revenue has by contrast, the effect of stimulating steel consumption. A substantial expansion in domestic product entails an increase in investment activity, and therefore a subsequent increase in steel requirements. An increase in the rate of growth of domestic product should therefore lead to a higher value of elasticity of consumption/ revenue.

The figures in the table show the rates of increase of gross domestic product and consumption of steel *per capita,* and the corresponding average elasticity, for the period 1965 to 1974.

In most of the countries the expansion of consumption was slower than the expansion of gross domestic product, with elasticity coefficients varying between 0·53 and 0·88.

In Italy and Ireland, however, steel consumption expanded at a more sustained pace than that of gross domestic product (elasticity 1·30 and 2·03 respectively). In the United Kingdom the elasticity coefficient was negative for the period as a whole, with steel consumption *per capita* in 1974 being lower than the figure for 1965, a year of high economic activity in this country, and gross domestic product *per capita* being higher by 2·1 % per annum.

In almost all the countries there was a tendency for elasticity of consumption of steel in relation to GDP to decline in the period under review. The extension of the period 1965 to 1970 to the year 1974 shows the decline in elasticity in the latter years and indicates that a slackening in the growth of macro-economic parameters was generally accompanied by a more pronounced decline in the growth rate of steel consumption.

However, it must be borne in mind that in view of the shortness of the time periods in question, and in view of the sensitivity of elasticity to variations in annual growth rates of GDP, the indications which one can draw from this data concerning the evolution of consumption elasticity in the various countries must be regarded as rough approximations. For the United Kingdom in particular, a considerable proportion of the drop in steel consumption during the period 1970 to 1974 can be ascribed to the sudden economic downturn in 1971, and to the extremely low level of investment activity during the period in question.

The influence of economic expansion on the development of steel requirements is explained not only by the level of national product and its growth rate but also by the employment of national product in terms of investment, consumption and exports.

Investment, from which a substantial proportion of a country's steel requirements originates, constitutes the driving force behind the expansion of steel consumption.

The following table shows that the countries which recorded the highest increases in gross fixed capital formation i.e., Ireland, Italy and France, were those in which the increase in steel consumption was highest in the period 1965 to 1974. The decline in investment growth (expressed by a drop in the average annual rate of increase of gross fixed capital formation), which occurred in all the Community countries in the period 1970 to 1974 compared with 1965 to 1970, is reflected by a general decline in the growth rate of steel consumption.

The countries in which this phenomenon was most clearly apparent are Germany and Italy. The respective rates of increase of investment activity dropped from 4·5 % to 0·4 % and from 7·4 % to 3·2 % per year in the two periods, while the expansion of steel consumption fell from 4·4 % to 1·0 % per year in Germany and from 8·0 % to 4·5 % per year in Italy.

Obviously, the expansion of consumption of durable goods, whose steel content is fairly high, also plays an important role in determining the development of steel consumption.

Finally, attention must be drawn to the importance of exports, because of the repercussions they have on internal demand for steel through exports of goods containing steel (indirect steel exports).

Average annual growth rate of some macro-economic parameters in Community countries during 1965 to 1974

	Germany	France	Italy	Holland	Belgium	Luxembourg	United Kingdom	Ireland	Denmark	EEC
Gross fixed capital formation	+ 2·6	+ 6·9	+ 5·5	+ 3·7	+ 4·2	+ 2·5	+ 2·4	+ 6·8	+ 4·6	+ 4·2
Consumption										
— private	+ 4·0	+ 5·4	+ 5·3	+ 4·7	+ 4·5	+ 4·3	+ 2·4	+ 4·0	+ 3·5	+ 4·1
— public	+ 3·8	+ 3·6	+ 3·6	+ 2·9	+ 5·0	+ 3·3	+ 2·4	+ 6·4	+ 7·0	+ 3·5
Total exports of which	+ 11·0	+ 12·0	+ 9·8	+ 10·2	+ 9·3	+ 6·1	+ 6·1	•	+ 7·0	+ 9·6
Indirect steel exports (1)	+ 9·7	+ 12·5	+ 11·5	+ 15·0	+ 8·3		+ 4·0	•	•	+ 7·9 (2)

(1) 1965 to 1972.
(2) Countries of the Community in its original composition plus United Kingdom.

The stimulating effect of the expansion of indirect steel exports on domestic steel consumption varies in intensity from country to country depending on the ratio of indirect steel trade (including steel products outside the Treaty) to domestic consumption. During 1965 to 1972, for which indirect steel trade statistics are available for the six original member countries of the Community and for the United Kingdom, net indirect steel exports represented on average about 25 % of domestic consumption in Germany and Belgium/Luxembourg, 18 % in the United Kingdom, 14 % in Italy and 10 % in France. A different situation exists in the Netherlands because imports of goods containing steel are higher than corresponding exports. From these findings, one can thus see how the export factor, and its development, affects the expansion of internal steel consumption to different degrees in the various countries.

The evolution of gross domestic product, already discussed above, its rate of expansion and the pattern of its development are reflected in the levels of activity of user sectors on which steel consumption is directly dependent. It is interesting to trace the development of the steel user sectors in order to check the extent to which the development of their activity in the period under review explains the decline in the growth of steel consumption.

If we compare the development of industrial production with that of the activity of steel user sectors, we find that the former developed more quickly than the latter in the period between 1965 and 1974. For the Community as a whole, the average annual rate of development of industrial production was 4·8 % compared with 3·8 % for steel consumer sectors. This indicates that the expansion of industrial production was mainly attributable to sectors which are not direct steel consumers, with the result that the elasticity of steel consumption with respect to industrial production declined. This change in the composition of industrial production, with a shift towards a slacker pace of expansion in steel user sectors than in other sectors, has become even more pronounced in more recent years.

The expansion of steel consumption may also have been influenced by the changes which occured in the respective development curves of the various consumer sectors. A reduction in the elasticity of steel consumption may have been caused by the fact that during the period under review some major steel consumer sectors progressed less favourably than other branches of the transforming industry.

From an analysis of the activity of the various steel consumer sectors during the period in question it emerges that, whereas the development of certain major steel consumer sectors such as primary transformation (especially tube manufacture, cold rolling, drawing and wire-drawing) was generally better than average, activity in other major consumer sectors, particularly building and public works, expanded more slowly.

The relatively sharp increase in some sectors may have only partially offset the decline in the growth of consumption due to less rapid expansion in other major steel consumer sectors.

The figures in the following table summarize the development of activity in some consumer sectors at Community level. The figures for the various sectors must be regarded only as orders of magnitude because of the non-uniform nature of the basic data used.

Average annual rates of growth of industrial production and the activity of steel consumer sectors in the Community

	1965—1970	1970—1974	1965—1974
Industrial production	+ 5·6	+ 3·8	+ 4·8
Activity of steel user sectors	+ 4·8	+ 2·5	+ 3·8
of which:			
— primary transformation (1)	+ 5·9	+ 5·3	+ 5·6
— mechanical engineering	+ 4·9	+ 3·6	+ 4·3
— motor vehicle manufacture (2)	+ 7·8	+ 1·0	+ 4·7
— shipbuilding (2)	+ 5·7	+ 4·3	+ 5·1
— building and public works (2)	+ 2·0	+ 1·0	+ 1·5

(1) Tube manufacture, cold-rolling, drawing and wire-drawing for the six original member countries.
(2) Figures for the six original member countries and the United Kingdom.

When analysing the development of steel consumption it is also necessary to bear in mind that the steel requirements of the user sectors are affected by their activity by virtue of specific consumption too. The development of specific consumption therefore conditions the development of overall consumption.

There are various reasons for changes in specific steel consumption, including the substitution between steel and rival products, saving on steel tonnage by replacing a steel product with a lighter one or reducing the weight of an actual steel product, changes in the type and shape of steel products used, more economic use of steel, changes in the production programmes of the various sectors, etc.

Although there is no precise information about the scale on which specific consumption has declined in the various sectors, there is no doubt that it has some effect on the fall in elasticity of consumption.

After analysing the phenomena which influence the long-term trend of steel consumption, it is interesting to study the short-term variations in steel consumption as a function of fluctuations in the economic cycle. The sensitivity with which the steel market reacts to variations in the short-term economic situation is well-known. The cyclical variations, to which the steel market is subject, are sometimes longer and of greater amplitude than those of the economy as a whole and especially those of manufacturing industry.

The figures in the following table illustrate this fact. They show that the annual variations in steel production are generally more pronounced, in one direction or another, than those of industrial production and the activities of the user sectors.

Annual variations in production (%) in the Community

Year	Crude steel production	Activity of the steel consuming industry	Industrial production
1965	+ 3·6	+ 4·1	+ 4·7
1966	— 3·2	+ 1·0	+ 3·6
1967	+ 4·0	+ 1·0	+ 1·7
1968	+ 9·4	+ 5·9	+ 8·5
1969	+ 7·4	+ 11·2	+ 9·4
1970	+ 2·5	+ 5·0	+ 5·0
1971	— 7·2	— 1·6	+ 2·0
1972	+ 8·6	+ 2·4	+ 4·7
1973	+ 7·9	+ 6·3	+ 8·3
1974	+ 3·7	+ 3·1	+ 0·6
1975	— 19·5	— 7·9	— 7·8

Steel requirements, like requirements for all basic products, react somewhat prematurely to variations in the levels of activity of sectors producing more sophisticated products intended for final consumers. Thus in general steel requirements tend to anticipate changes in economic development.

This phenomenon is, however, sometimes offset by the fact that some major steel consumer sectors, such as producers of capital goods, always react more slowly than other sectors to short-term variations, either in one direction or another.

It is occasionally possible, therefore, to detect a certain time-lag between the adjustment of the trend of steel requirements to the general economic trend. This is what happens, when, in periods of economic recovery, steel consumption recovers more slowly because of the slower revival of investment activity.

Domestic requirements of steel products are normally composed of the real consumption of the manufacturing industry and changes in the level of working steel stocks of users, merchants and producers. Short-term fluctuations in real consumption depend on fluctuations in the activity of the manufacturing industry; variations in working stocks are also related to the levels of activity of manufacturing sectors, merchants and the iron and steel industry itself.

However, in some phases of the economic cycle, the movements of users' and merchants' stock are out of proportion to their levels of activity. This has the effect of amplifying short-term variations in domestic steel requirements. In periods of buoyant business activity, total demand is higher than the requirements resulting from real consumption and the increase of operating stocks, because the accumulation of users' and merchants' stocks is pushed beyond the levels of operational necessity. On the other hand, in periods of economic slackness, these excess stocks are disposed of and total demand is lower than real requirements.

During periods of favourable business activity, when strains appear on the steel market, prices rise and delivery times are longer, purchasers thus protect themselves against subsequent price increases and possible shortages by increasing their demand beyond the level of their own requirements and building up their stocks. The result is a situation of stock saturation which, as soon as the first signs of a slackening of market strains appear and fears of supply difficulties disappear, gives rise to a contraction of total demand to allow re-absorption of stocks in excess of the normal operational quantity.

The amplification of short-term variations in internal steel requirements due to the stock cycle is a phenomenon which disturbs the steel market. This phenomenon contributes to accentuating the strains on the market in periods of favourable economic activity and plays a particularly harmful role during slack periods by accentuating the decline in demand with all the consequences this implies on the use of production capacity, maintenance of a reasonable price level and stability of employment.

The period between 1965 and 1974 includes two complete economic cycles. The enclosed graph shows that, at Community level, the period 1965 to 1970 was marked by a phase of slack demand for steel until 1967 followed by strong expansion of consumption between 1968 and 1970. In the first three years of this period, apparent consumption of steel by users was below the level of real consumption because of a reduction in users' stocks, this reduction being at an average rate of about two million tons per year.

Subsequently in 1968, 1969 and 1970, the Community steel market was marked by a strong expansion of consumption. Apparent consumption by users rose well above real consumption and in 1969, stocks rose to the level of about seven million tons of crude steel. This excessive increase in users' stocks, which continued until mid-1970, had a pronounced impact on the market in the following two years and contributed substantially towards the decline in demand. The period 1971 to 1974 was marked by an initial phase of slack economic activity which lasted until mid-1972, after which activity recovered and buoyant conditions prevailed throughout 1973 and the first half of 1974.

In 1971 and the first part of 1972 real consumption declined as a result of a reduction in the activity of the primary transformation industries and certain capital goods' industries; even the activity of the building sector underwent only moderate expansion, and in certain countries it declined. As stocks were run down sharply (by 5·5 million metric tons in 1971) apparent consumption by users dropped far more steeply reaching a level below that of real consumption. It was in 1971 some 8·5 million metric tons less than in the previous year.

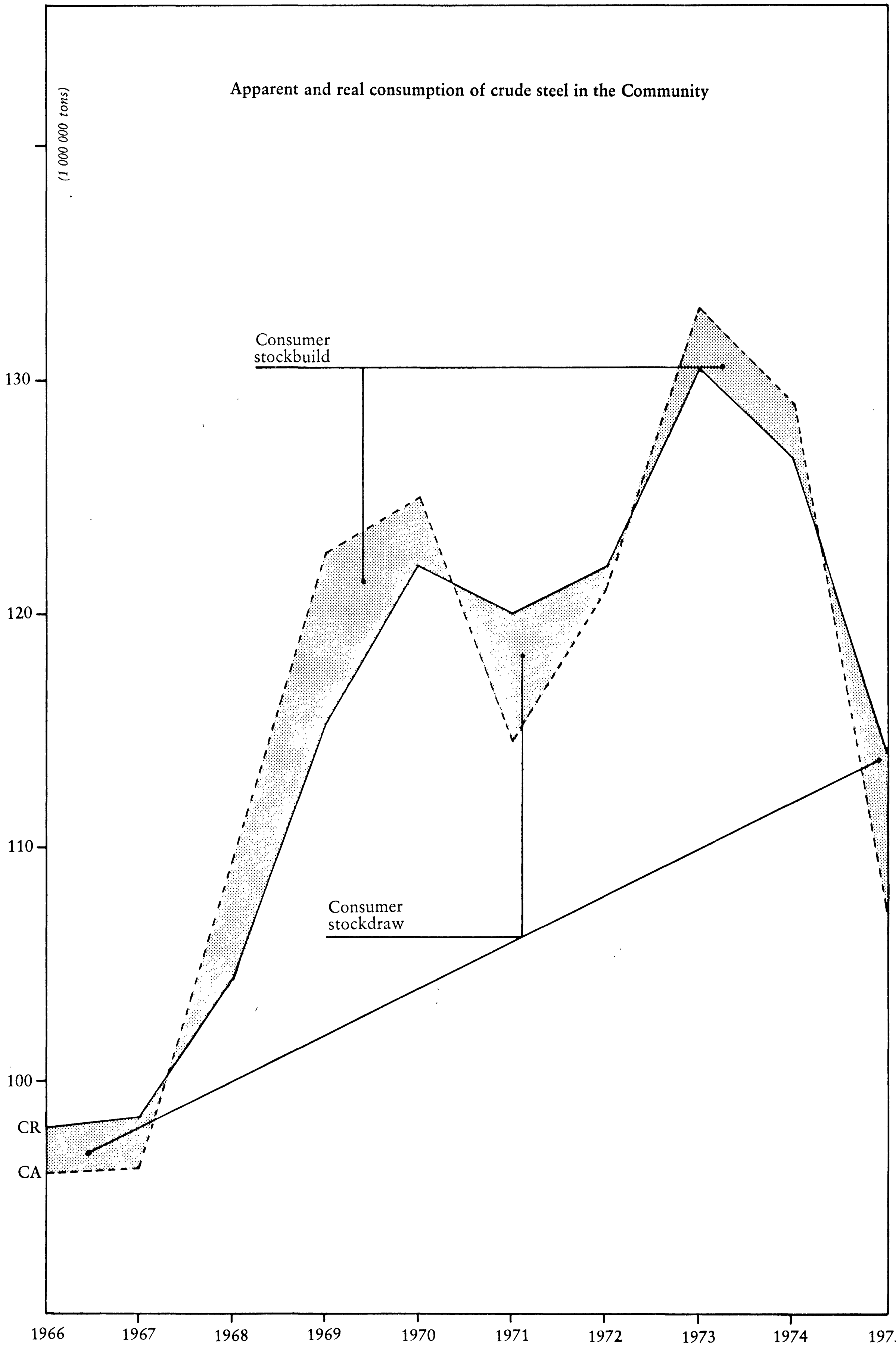
In 1972 there was a moderate recovery of real consumption, related to a rather slow recovery of activity in the capital goods sectors. By the end of 1972, real consumption once more regained its 1970 level. However, despite an increase of almost seven million metric tons, apparent consumption by users still remained below the level of real consumption and almost four million metric tons below the level it had attained two years previously. This fact was due not only to the continuing — if less marked — depletion of stocks by users in 1972, but above all to the strong increase in stocks in the previous period of favourable activity which had swollen apparent consumption by users excessively.

In 1973 and the first half of 1974, real consumption of steel expanded very strongly. Apparent consumption, although higher than real consumption, did not depart very widely from it. This means that the increase in stocks was not much higher than the rise in working requirements to cover the increase in consumption. The particularly long delivery times and increased prices of steel did not therefore give rise to an increase in stocks during the buoyant period of 1973 to 1974, as high as that in earlier phases of favourable business activity. It is highly likely that the rise in the cost of credit played an important role in restraining the trend towards excessive stock increases, even if it was not the only factor to have influenced users' stock management policy.

As regards trends in the individual countries, differences were observed in the rate of variation of consumption and in the extent of stock movements. In all countries, however, the level of apparent consumption was higher than that of real consumption in the boom periods and lower — even in the countries where real consumption, instead of declining, merely saw its rate of increase slacken, in periods of sluggish economic activity.

Demand for steel, which had remained very strong in all countries throughout the first half of 1974, dropped sharply after the summer of that year. The drop in demand was mainly due to a distinct slackening of activity in many branches of the manufacturing industry and especially in primary steel processing, motor vehicle manufacture, building and public works, resulting in a contraction of real steel consumption. The decrease in consumption in these sectors was however partially offset by an increase of steel consumption in other sectors (tube manufacture, shipbuilding, mechanical engineering), which therefore prevented an even sharper decline in demand. The tendency for steel demand to decrease was accentuated by stock depletion.

Thus 1975 is situated in a descending phase of the economic cycle, marked by a considerable reduction in steel consumption in relation to the level of the previous year, in all countries. This reduction was in most countries the largest registered since 1953.


Apparent and real consumption of crude steel in the Community
(1 000 000 tons)
130
120
110
100
CR
CA
Consumer
stockbuild
Consumer
stockdraw
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975

The steel market's sensitivity to variations in the economic situation is all the more apparent if, in addition to the trend of steel demand, one considers the trend of prices.

The trend of steel prices inside the common market, as reflected in the variations of basic prices given on the price lists forwarded to the Commission by the steel undertakings, showed a tendency to stagnate, if not decline slightly, up to the years preceding the boom of 1969 and 1970. The levels of list prices during the favourable period 1960 and 1961 were not exceeded in the following years, so there was a slight and gradual deterioration of prices up to the years 1967 and 1968, at which point they dropped quite substantially. During all of this period, steel prices did not cease to decrease in relation to the general level of prices for industrial products. A comparison between the trend of wholesale prices for industrial products and wholesale prices for steel products, in the six original countries of the Community, shows that the index of relative prices for steel declined by 16 % between 1961 and 1968. More specifically, while the index of wholesale prices for industrial products rose by 10·7 %, that of wholesale prices for steel products declined by 7·5 %. From 1969 onwards, steel prices increased substantially, and regained a fair proportion of the ground that they had lost.

Despite the sharp increases recorded in prices of iron and steel products between 1969 and the end of 1973, these prices still lagged behind those for other industrial products.

The increase in wholesale prices for steel products between the beginning of 1969 and the end of 1973 was about 45 % in the original member countries of the Community, whereas the price increase for industrial products was 30 %, which shows a relative improvement in steel prices during that period; however, in 1973 the relative steel price index was still 6 % below its level of 1961, thus confirming the more rapid increase in prices for other industrial products compared with steel over that period.

The trend of list prices is only a very mild reflection of the fluctuation of real prices.

In fact most undertakings change their list prices fairly infrequently and often adopt the practice of alignment on the lowest list prices of their competitors inside the common market and the terms of sale offered by competitors in non-member countries.

The reports which the steel industry forwards to the Commission pursuant to High Authority Decision 9/67 provide information on sales made on these price terms rather than at list prices.

The reports indicate that, in normal economic conditions, generally speaking less than half the sales in the Community are made by steel undertakings at their own list prices. The percentage of such sales drops sharply during periods of slack economic activity. In some countries, steel undertakings sell only a minimum percentage of their production at their own list prices.

The three new member countries began publishing list prices in 1973. In that year basic prices in the UK were lower than the lowest list prices published in the Community in its original composition. During 1973 and 1974 basic list prices increased substantially even in the three new member countries; at the end of 1974 the average level of list prices in the UK was equal to the lowest level published by the members of the Community in its original composition.

The marked slowdown of activity on the steel market after the summer of 1974 had immediate repercussions on steel prices. Towards the end of 1974 temporary cuts were being made in list prices and there was an increase in alignments on the lowest list prices and on quotations from non-member countries. In 1975 this trend continued and list prices together with actual prices dropped sharply for all products in the Community.

B — *FORECASTS OF STEEL CONSUMPTION IN THE COMMUNITY IN 1980 AND 1985*

Two basic parameters were laid down before work commenced on the preparation of the forecast. These were the base year to be used and the definition of the branches to be treated in the forecasting exercise.

In respect of the base year the objective is, of course, to select, if possible, a year of average economic activity. However in practice the freedom of choice was severely limited by the availabilities of compatible statistics for each country, this being particularly restrictive in respect of the new member countries. In fact the year 1972 was the only year in which the availability of steel consumption data by branch on a common basis could be guaranteed. It was in general also fortunately a year of average economic activity. However, while this was true at a Community level, it was not valid for all countries in the Community, e.g. the United Kingdom and Ireland, or indeed for all branches in every country, i.e. there are some branches with better than average growth rates for the period 1972 to 1980 simply because 1972 was a poor year for that branch. Of course, it would have been ideal, had the availability of statistics permitted it, to have used an average consumption for two to three years as base for the branch forecasts.

The definition of the branches was that laid down in the Statistical Office of the European Communities Questionnaire 2—73 on steel consumption by branch. This definition of branches conforms with that laid down in the UN standard industrial classification.

The forecast of the development of steel consumption in the nine member countries of the Community over the period 1972 to 1980 was established by the so-called 'sector' approach. This method consists primarily of three basic procedures, namely:

— the formulation of forward estimates through to 1980 of the principal macro-economic aggregates for each country, e.g. gross national product, consumer expenditure, government expenditure, fixed investment in the public and private sector, import and export of goods and services etc. All of these aggregates, of course, are measured at constant prices, or, in others words, volume terms;

— the transformation for each country of the final demand vector consisting of the above estimated macro-economic aggregates into terms of demands on the various branches of the economy in the horizon year and in particular on the steel consuming branches. This procedure of determining how the various demands specified by the macro-economic aggregates might be satisfied produces as an end result a forecast of the level of activity in each branch of the economy, i.e. it is in effect a supply and demand balance for the total economy. The resultant levels of activity can be expressed in a number of different units, e.g. weight, volume (value at constant prices), etc.;

— the estimation of specific steel consumption, i.e. the amount of steel by weight consumed per unit of activity, in each branch in each country in 1980.

Thus total steel consumption in any country of the Community in 1980 is defined as:

$$\sum_{j=0}^{n} \sum_{i=0}^{n} a_{ij} \cdot A_i \cdot S_j$$

where

A_i = a column vector defining the 'i' elements of the macro-economic indicators for 1980 in a particular country.

a_{ij} = a matrix which defines the relationship between the 'i' elements of the macro-economic indicator vector and the level of activity in the 'j'th branch of the economy in 1980. This may, for example, be an input-output matrix or consist of coefficients derived from a series of multivariate econometric relationship.

S_j = a row vector defining the specific steel consumption in the 'j'th branch of the economy in 1980.

In the present exercise the task of producing the estimates of the macro-economic aggregates and the specific steel consumption was undertaken in principal by the services of the Commission while that of deriving the activity levels of the branches in the Community countries was subcontracted to a number of internationally reputed economic research institutes (1).

The forecasts for the macro-economic aggregates for 1980 were based on the medium-term projections for each of the member countries through to 1978 prepared by the services of the Commission in conjunction with the respective government services in the member countries. These projections were formulated during the winter of 1973/74 when the ultimate effects of the coalescence of rampant inflation, socio-economic problems, and increased prices of oil and other raw materials with the resultant balance of payments deficits had not fully manifested themselves. It was assumed in these projections that total world trade would continue to grow in the region of 7 to 8 % per annum, oil prices would be maintained at their end-1973 levels and that the government of the member countries would continue action to counter inflation. In these circumstances the experts foresaw a real growth of 4·3 % per annum in gross national product for the Community in the period 1972 to 1980. This represented a small deviation downward from the long-term trend (the period 1960 to 1972) of some 0·25 % per annum but was much higher than the average achieved during the last 4 to 5 years. In the late spring/early summer of 1974 when the research institutes were in process of commencing their task it became clearly evident in a rapidly deteriorating economic climate that even an average growth rate of 4·3 % per annum for gross national product in real terms could scarcely be achieved in the period 1972 to 1980.

Thus the first research task was to examine the potential for economic growth in the Community in the light of the changing economic environment and

(1) See introduction.

amend the proposed growth rates for the period 1972 to 1980. The result of this exercise was a further reduction of some 0·2 % per annum in growth trend for the Community and it is this level of marginally under 4·1 % per annum that formed the basis for the projections of activity level by branch for each country.

This projection is broadly based on the hypothesis that the economies of the member countries will go through a period of structural readjustment during which the growth rate will be below the long-term trend of 4·5 % that prevailed during the years from 1960 to 1972.

In respect of the utilization of the gross national product a diversion of resources into exports to cover the increased costs of imported oil is foreseen. This is compensated by a marginal reduction in the proportion of resources in real terms devoted to personal consumption and a fall off in the share of fixed investment in the national product of the member countries, this latter largely being the result of the slowdown in the construction and public works branch. Furthermore a swing is anticipated in the direction of fixed investment in plant and equipment towards branches involved in the search for and exploitation of alternative sources of energy. This investment is estimated to amount to *c.* 1 % of the gross national product per annum.

However the rapid deterioration in the economic situation in the second half of 1974 and first half of 1975 has made even the revised projections seem optimistic. On the basis of the GNP data for 1973 and 1974 and the latest estimates for 1975, it would be necessary to achieve a growth rate of 5·5 % per annum during the five-year period 1976 to 1980 in order to reach the estimated level of GNP for 1980. This rate is certainly higher than the medium-term growth rates observed in the past, although the fact is that at no time during the past twenty years has there been unused production capacity and under-employment of resources on the scale that exists at present.

In view of this situation, the estimated 5·5 % for the period 1976 to 1980 will have to be adjusted to a more realistic level, though it will still be kept at the upper limit of the range of possibilities.

Since the macro-economic basis lies at the upper limit of the forecast range it follows that the estimates of steel consumption constitute the upper bound of the forecasts for consumption in the Community.

In carrying out such studies one is confronted not only with the conventional problems, e.g. lack of statistical data, but also the suspicion that the recent economic plunge brought with it some more durable changes in the structure of the member country economies which immediately invalidated many historical relationships.

This of necessity introduced a considerable element of qualitative analysis into all the studies and indeed in some cases conditioned the approach of the researchers by diverting them away from a rigorous mathematical analysis of the problem. The national differences in availability of statistical data has given rise to an interesting spectrum of approaches ranging from the use of sophisticated input-output models through sector by sector analysis using a combination of econometric models and qualitative analysis based on expert opinion drawn from the sectors to a micro-econometric analysis by product groups.

The third component of the forecasting equation was the specific consumption of steel in the sector. This is defined as the weight of steel consumed in a sector to produce one unit of output where this may be measured in terms of weight or value at constant prices or in numbers produced. Our forecasts of specific steel consumption in 1980 was based on three sources:

— a survey carried out by the Commission among steel consumers in the Community,

— extrapolation of statistical series indicating specific consumption in a sector over a period of years,

— the use of data from special reports on the sectors prepared for the services of the Commission, in particular the SOEC.

The survey was executed with the aid of the user associations in the member countries. They not only dispatched and collected the questionnaires but also in a number of cases processed the answers of their members. The questionnaire was formulated with the aid of the steel producers and the consumer associations.

Since this was the first general enquiry made among the actual consumers of steel in this matter and in view of the complex nature of the subject and the time horizon of 1980 it was decided to devise a relatively simple questionnaire. The consumer was asked three types of question about the trends in steel consumption in his plant, namely:

— qualitative questions on the factors influencing trends in specific consumption of steel in his plant. He was asked here to rank a number of factors into one of three classes — important, less important, negligible. The responses to these questions furthermore were designed to act as a check on the answers to the quantitative questions,

— questions where the firm replying was asked to specify in percentage terms within broad ranges the likely changes over the period 1972 to 1980 in the specific consumption of long and flat products in its plant,

— questions to facilitate the analysis of the results of the questionnaire.

The questionnaire met a favourable response among steel users —yielding in excess of 1 000 replies — in six of the nine Member States although the quality of the returns was variable and on occasions lacked credibility. Nevertheless the enquiry did produce some valuable indicators and information for inclusion in our pool of data on the subject of specific consumption particularly when account is taken of the initial nature of the venture.

The pool of data resulting from the three approaches was submitted to both experts inside and outside the steel industry for their consideration and comments.

The results, in so far as they proved credible, were incorporated after these discussions in the estimates for 1980. In general our investigations indicated that, when specific consumption in a branch of industry is measured in terms of tons of steel used per ton of production, we can expect fairly modest changes in specific consumption over the period 1972 to 1980 usually in a downward direction within the bracket 0—5 %. This is consistent with the historical development over the preceding 10 to 15 years.

It is the intention of the Commission to further pursue their investigations into this subject in particular benefiting from the experience and lessons learnt during the survey.

The consumption of crude steel in the nine Member States in the year 1980 is estimated to reach 156·5 million metric tons, an increase of some 34 million metric tons over the base year of 1972 (see the following table). This represents an average annual rate of increase of some 3·2 % over the period 1972 to 1980. It should be borne in mind that this rate of increase is to some extent distorted by the increasing impact of continuous casting which reduces the amount of crude steel required to produce a given quantity of finished products. Thus, if we make the comparison on the base of consumption of finished products, the average annual rate of increase becomes 3·68 % for the period 1972 to 1980.

Forecast steel consumption 1980

(upper limit)

Country	Finished products (million metric tons)		Crude steel (1) (million metric tons)		% Increase per annum 1972 to 1980		
	1972	1980	1972	1980	Finished products	Crude steel (1)	GNP (2)
F.R. Germany	33·6	43·0	42·6	52·5	3·1	2·6	3·9
France	18·9	25·9	24·3	31·6	4·0	3·3	5·2
Italy	16·1	23·2	20·3	28·3	4·7	4·3	4·0
Netherlands	3·1	4·3	4·3	5·2	4·1	2·7	3·9
UEBL	4·6	6·6	5·5	8·0	4·6	4·9	3·9
United Kingdom	18·0	22·7	22·8	27·7	2·9	2·4	3·0
Denmark	1·5	2·2	1·9	2·6	4·4	3·8	4·1
Ireland	0·3	0·4	0·3	0·5	6·4	5·9	3·5
Community	96·0	128·3	122·0	156·5	3·7	3·2	4·1

(1) Semis from continuous casting not converted into ingots.
(2) Measured at constant prices of 1963.

Coefficient of conversion into crude steel
1973 = 1·27 1980 = 1·22

The above growth rate lies indeed under the growth in the years 1965 to 1970, the latter being 4·5 % per annum, but clearly above the growth rate in the years 1970 to 1974, this being only 1·3 %. It is thus clear that an estimated Community consumption of 156·5 million metric tons represents a maximum. It would be astounding if, in the light of the severe economic difficulties which have weighed heavily upon the economies of the Community in the last few years and which will probably endure for at least some time, such a high objective were to be attained. At a time when the maintenance of full employment no more occupies the absolute priority in the economic policy of governments, the fight against inflation and disequilibria of balance of payments has led to a clear change in direction of economic policy under which one certainly cannot expect an acceleration of the long-term growth of steel consumption. The above estimate can thus only be regarded as an upper bound of a range of possibilities. We will later indicate the steel consumption related to an average rate of development; initially however, we will examine the upper bound forecast by country, sector and product.

The growth of consumption of finished products in the Federal Republic of Germany in the years 1965 to 1970 was 4·4 % per annum and between 1970 and 1974 was only 1·8 % per annum. For the forecast period 1972 to 1980 an average annual growth rate of 3·1 % was estimated. The remarks made above about the Community estimates apply to the Federal Republic of Germany in so far as they relate to the effects of inflation. Moreover private housing building and automobile construction will weigh heavily upon the growth of steel consumption in the coming years. The retarding influence of these sectors will probably be only partly balanced by the more favourable outlook for tube plants and tankage construction.

In the case of France the estimated growth of consumption of finished products through to 1980 is forecast at 4·0 % per annum. In comparison the growth for the period 1965 to 1970 is calculated at 6·2 % and from 1970 to 1974 as 3·4 %. This latter growth reflects not least the fact that also in France steel consumption is clearly feeling the results of the abovementioned economic difficulties. In France however the prospects for the automobile and building industry are probably somewhat more favourable than in the case of the Federal Republic of Germany. It is likely that in France a stronger growth of steel consumption than in the Federal Republic of Germany will take place.

In Italy the annual increase of consumption of finished products in the period 1965 to 1970 was 8·0 % and 5·3 % in the years 1970 to 1974. The growth rate for the forecast period 1972 to 1980 is by contrast estimated at 4·7 % per annum. Italy is more preoccupied than the two preceding countries in the struggle against economic and social problems.

In the case of Great Britain the consumption of finished products increased by 1·0 % annum in the period 1965 to 1973. The estimate through to 1980 shows by contrast a yearly increase of 2·9 %. This growth is based primarily on a faster economic expansion than in the past as well as an increase in the share of fixed investment in the national product. This forecast, which so clearly deviates from the historical development, must in the light of the considerable economic and social difficulties facing this country represent a maximum objective.

For the smaller steel consuming countries — Belgium, Denmark, Ireland, Luxembourg and the Netherlands — the estimated growth rates of consumption of finished products also lie above the rates achieved in the period 1965 to 1974. In all these cases the forecasts must be characterized as maxima in general for the abovementioned reasons.

The salient features of the forecast of steel consumption by branch are shown in the following table. Here we see that the growth branches in the period 1972 to 1980 are those closely connected with the exploitation of new sources of energy, namely the steel tube and boiler industries. This situation clearly reflects the forecast increase in fixed investment in the energy exploitation industries.

By contrast the high performance branches of the last decade — the automobile and building/construction industries — are among those branches with the lowest rates of increase for the period 1972 to 1980. The former is suffering among other factors from the aftermath of the energy crisis but most experts foresee an upturn in activity in this industry in 1976. Thus only a small decline in importance of this branch as a steel consumer is foreseen in the maximum growth case.

While the recession in the motor industry is of relatively recent origin that in the building and construction industry has been in evidence since the beginning of the seventies. The original impetus for the recession in this sector came from the inflationary price development and high interest rates. There is no doubt that the persistence of the crisis could be further accentuated in many of the member countries by the continued inflation which eliminates many potential buyers from the market because of shortage of liquid capital and the existence in certain areas of a surplus of accommodation in the housing and office sectors. It is felt that this surplus will not be cleared before 1980. In most countries governments have undertaken measures to stimulate recovery.

Consumption of finished products by branch in the Community 1972 to 1980
(upper limit)

Branch	1972		1980		Average annual increase 1972 to 1980 %
	Consumption (million metric tons)	%	Consumption (million metric tons)	%	
Primary transformation (excluding steel tubes)	21·2	22·0	27·0	21·0	3·1
of which:					
Forging and pressing	4·3	4·5	5·1	4·0	2·2
Wire-drawing	6·4	6·7	8·1	6·3	3·0
Cold rolling and manufacture of cold formed shapes	5·0	5·2	6·5	5·1	3·3
Steel tube industry	12·1	12·6	18·5	14·4	5·4
Machinery (non electric)	9·1	9·5	12·4	9·7	4·0
Machinery (electrical)	2·6	2·7	3·7	2·9	4·5
Shipbuilding	3·3	3·4	4·2	3·2	3·0
Automobile	10·2	10·6	12·7	9·9	2·8
Structural steelwork	6·0	6·2	7·6	5·9	3·0
Building and public works	11·5	12·0	13·9	10·8	2·4
Hardware, cutlery	4·4	4·6	5·8	4·5	3·5
Cans and metal boxes	2·7	2·9	3·5	2·7	3·3
Boilers	3·7	3·8	5·2	4·1	4·5
Other	9·3	9·7	13·8	10·8	5·0
Total Community	96·0	100·0	128·3	100·0	3·7

Prospects in the industrial construction and public works sector seem somewhat better than those of the housing and office building sectors.

Activity in the non-electrical machinery branch is forecast to grow in all member countries at least as rapidly as overall output. There are a number of factors behind this expansion such as the possible exploitation of the export markets presented by the rich oil-producing lands of the Middle East, the increased investment in energy on the domestic scene, increased fixed investment as in the United Kingdom or in the smaller countries some restructuring of the industry leading to expansion.

The growth rate forecast for the electrical machinery branch is the result of a recession in the sales of domestic electrical and electronic appliances, outweighing the buoyant growth foreseen for the branch under the impact of the substantial nuclear energy programme.

Growth rates in the shipbuilding branch are somewhat depressed because of the surplus of tankers resulting from the slowing down of oil demand plus the effects of the re-opening of the Suez Canal. The impact of these factors is modified by the upsurge of demand for specialist ships, e.g. supply ships for North Sea operations and liquid natural gas carriers.

The structural steel works branch has in a similar manner to the building and construction branch suffered a recession primarily due to inflation in member countries. Some alleviation will of course come from the construction of platforms and drilling rigs for North Sea operations and from energy investment programmes.

Steel demand in the primary transformation sectors (excluding the steel tube industry) is in the medium term deflated by the downturn in growth rates foreseen in such major customer branches as the automobile and building/construction industries. This can be seen in the case of the forging and pressing sector, a large supplier to the motor industry.

Activity in the remaining sectors is forecast to grow at around the overall rate of increase with no significant impact on the trends in demand for steel. As already mentioned, all the forecasts detailed above are constituent parts of the maximum or upper limit forecast.

The development of consumption by product for the upper bound forecast through the period 1972 to 1980 is shown in the following table.

Development of consumption by product — 1972 to 1980

(1980 upper limit)

Product group	Consumption (million metric tons)		% annual increase	Proportions (%)	
	1972	1980		1972	1980
Liquid steel	1·8	2·3	3·3	1·88	1·83
Coils (finished product)	6·7	9·7	4·8	6·96	7·55
Ingots for tubes	2·2	3·4	5·1	2·34	2·61
Other ingots/semis	4·5	5·5	2·6	4·69	4·31
Heavy sections	10·8	14·0	3·3	11·20	10·91
Light sections	18·9	24·2	3·2	19·65	18·90
Wire rod in coils	8·9	11·3	3·1	9·26	8·84
Strip	7·6	10·0	3·5	7·93	7·81
Heavy plate	11·2	16·9	5·3	11·61	13·17
Medium plate	1·7	2·1	2·7	1·74	1·61
Sheet	21·8	28·8	3·5	22·74	22·46
Total	96·0	128·3	3·7	100·00	100·00

The main features of the evolution of product demand over the period 1972 to 1980 indicated by the forecast are:

— products with an above average growth rates such as ingots for tubes, heavy plate are those which play a significant role in the branches nominated as the growth branches of the period 1972 to 1980, namely the steel tube industry and the machinery branch,

— the low growth forecast for the building/construction, structural steelwork, automobile and primary transformation branches are reflected in the less than average increases forecast for the product groups — other ingots/semis, heavy sections, light sections and sheet,

— despite the low rate of increase forecast for sheet the long-term trend toward more rapid growth in the demand for flat products at the expense of long products is expected to continue to a limited extent through to 1980,

— a continuation of the trend towards substitution of coils (as finished product) for plate and sheet is also anticipated in the estimate.

Having up to now considered a maximum development we will now seek to give the answer for an average trend.

For this purpose the long term trend of real steel consumption for the years 1953 to 1975 was first calculated for the Community in its original composition. As the annexed graph shows the actual values for the last 23 years are clustered very closely around a straight line with very few exceptions to which above all the year 1975 belongs.

This straight line is the graphical representation of the function

$$x = \alpha t + c$$

where x is the real steel consumption, t is time, α the regression coefficient and c, a constant, the interception of the axis. In this calculation based on crude steel the steel consumption is calculated as if there was no continuous casting.

If one extrapolates the function to the year 1980 one arrives at a steel consumption of 123·5 million metric tons for the Community in its original composition without considering continuous casting.

If one adds to this a small stockbuild of 1·5 million metric tons the total consumption reaches 125 million metric tons. When one makes the necessary reduction for continuous casting we obtain a result of 117·5 million metric tons. This estimate is in no way pessimistic; it represents much more the trend existing during a long period of years where only the last two have been restrained by the current economic difficulties.

For the three new members the statistics from the year 1965 onwards were used. These show that in the past years steel consumption stagnated at a level of *c.* 25 million ingot metric tons. The development in each of the countries however shows clear differences; a strong growth in Denmark and Ireland and a small decrease in Great Britain. In the case of these countries the values represented in the graph exclude the effect of continuous casting. As can be seen from the graph the forecast maximum lies clearly above the historical development. The forecast has a certain value as a maximum objective, the average trend must however lie at a lower level. If one establishes for the calculation of this average trend a margin derived from the historical development representing the difference between the maximum and the average trend, one arrives at a result of 31·2 million metric tons instead of 32·8 million metric tons. Taking account of continuous casting this represents with the inclusion of a small stockbuild *c.* 29·5 million metric tons crude steel.

In summary this gives for the Community a steel consumption under normal or average conditions of 147 million metric tons in contrast to the 156·5 million metric tons crude steel of the maximum development.

In the case of a weaker economic development the consumption of crude steel is estimated to reach 140 million metric tons.

Using the same long-term trends one reaches for the year 1985 for the average conditions a steel consumption of 165 million metric tons crude steel whereby a further increase in continuous casting is taken into account.

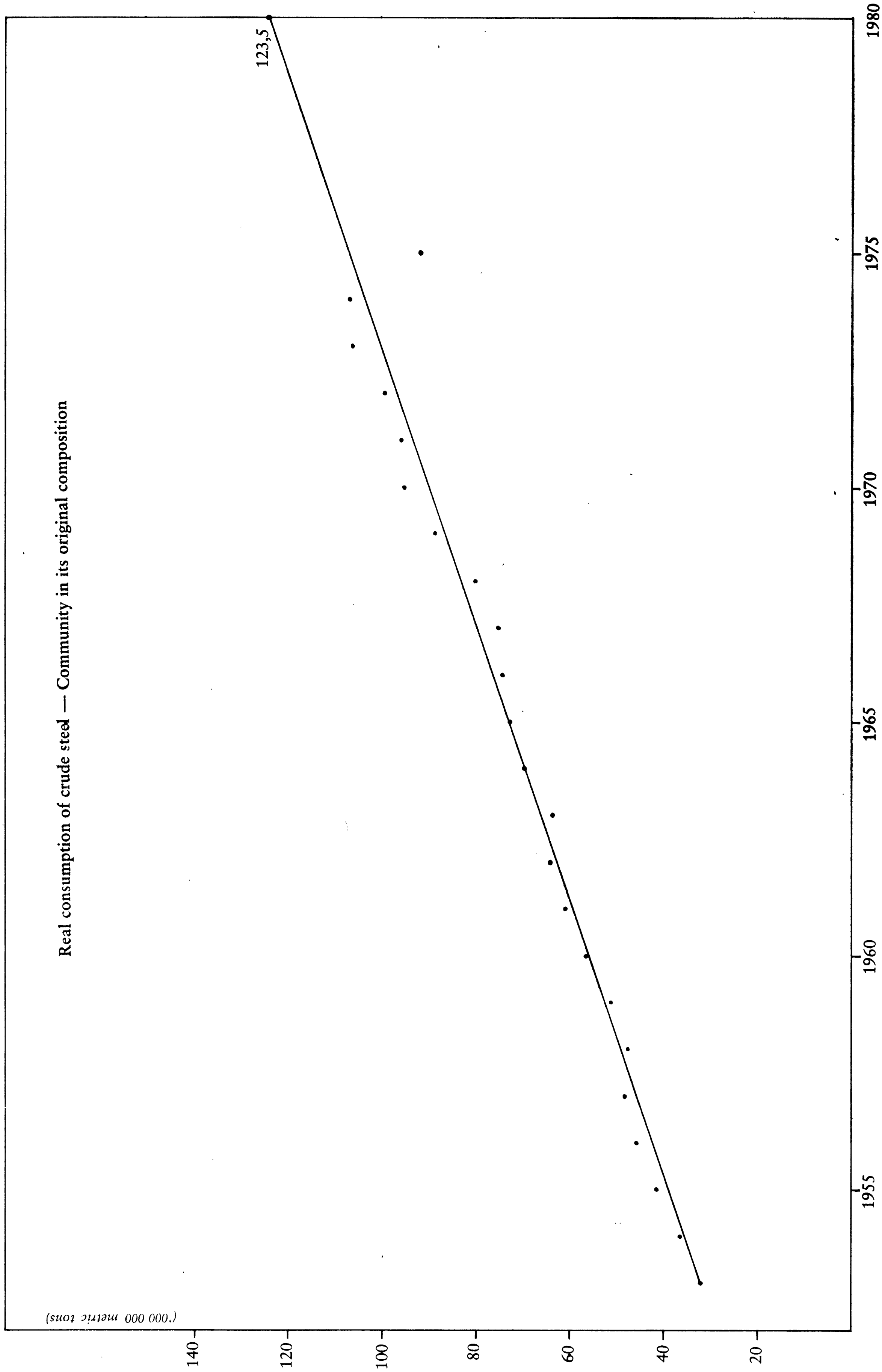
The results of this chapter are summarized in the following table.

Real steel consumption plus increase of the technically necessary stock levels in the Community

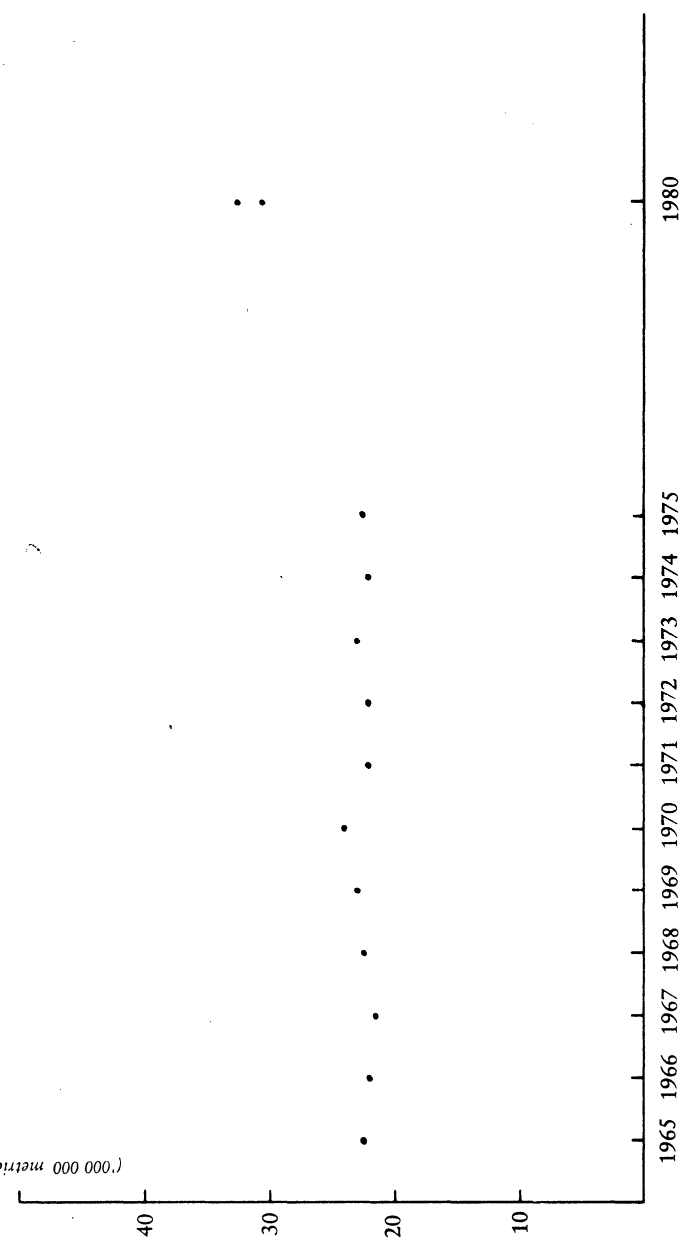
Year	Real consumption + crude steel stockbuild in million metric tons	
	Semis from continuous casting as semis	Semis from continuous casting in crude steel equivalent
1972	122·0	123·7
1973	130·4	132·8
1974	129·0	132·0
1980 a	140·0	149·0
b	147·0	156·5
c	156·5	166·5
1985 a	159·0	172·5
b	165·0	179·0
c	173·0	187·5

a = Lower limit. b = Average trend. c = Upper limit.

In respect of the demand for rolled steel products the share of flat products will continue to grow to a small extent between 1980 and 1985 with a corresponding reduction in the share of long products.



Real consumption of crude steel — Community in its original composition



Real consumption of crude steel — United Kingdom, Denmark, Ireland

CHAPTER II

A SURVEY OF THE WORLD STEEL MARKET AND THE COMMUNITY'S EXPORT TRADE IN STEEL

A — *HISTORICAL ANALYSIS*

Although the volume of steel exports was smaller than the volume of domestic sales, exports of the Community have had a considerable influence on the steel industry's level of production and earnings. Between 1970 and 1974, exports to non-member countries averaged 18 % of all steel produced in the Community. In the case of a number of companies this percentage was considerably higher. Because of the sharp fluctuations which are characteristic of export prices their effect on the steel industry's earnings was proportionately even greater than the influence exerted on the production level by the volume of exports.

Steel imports from non-member countries also had a considerable influence on the production level and earnings of the steel industry. These imports have been limited, certainly, but between 1970 and 1974 they represented not less than 7·5 % of the Community's domestic consumption. Here, too, prices have had a preponderant influence since, during periods when the market weakens, Community companies to a large extent align their prices on the lower import prices and so make correspondingly fewer sales at their own higher listed prices.

There is therefore every reason for paying special attention to steel exports; furthermore the export trade has regularly been subject to trade policy measures. Consequently some clarification of the most important past trends and future goals to be achieved is required.

Let us first look at the world steel market, seeking to present this as part of the total international trade flow of industrial products.

Between 1953 and 1972 world steel production achieved an average growth of 5·7 %. Since in many parts of the world there has been a greater increase in absolute terms in steel consumption than in production, the flow of imports from countries with a steel surplus has risen sharply. At the same time there has been a noticeable increase in steel trade between producer countries.

Hence, at an average annual growth rate of 9·1 %, world steel trade has far outstripped the increase in world steel production. International steel trade expressed as a proportion of world steel production has risen from 5·6 to 10·4 %.

World steel production and trade

Year	World steel production (million metric tons)	World steel trade [1] (million metric tons)	World steel trade as % of world steel production
1953	234·8	13·1	5·6
1956	283·5	19·5	6·9
1960	346·5	24·1	7·0
1964	437·3	31·0	7·1
1968	518·6	48·0	9·1
1972	626·2	65·0	10·4

[1] World steel trade is defined as trade between those countries and regions set out below, excluding internal trade within regions.

The growth in world steel trade is most impressive, but trade in industrial products as a whole has increased even more rapidly, with the results that steel's percentage share of total world trade in industrial products has decreased. This trend is particularly clear in the foreign trade of the Community and of North America. Iron and steel's percentage share of total exports of industrial goods from the Community decreased from 15·4 % in 1955 to 9·4 % in 1973. In North America there was a decrease from 6·4 to 3·1 %. In Japan, by contrast, this percentage has remained almost constant at about 15 %.

Iron and steel exports as a percentage of total exports of industrial products

Year	Community	North America	Japan	Rest of Western Europe	Eastern Europe	World	Developing countries	Industrialized countries
1955	15·4	6·4	15·0	6·2	12·1	9·6	1·3	10·0
1960	15·1	5·2	10·8	8·0	11·8	10·1	2·3	10·4
1965	11·0	4·0	16·6	6·7	12·4	8·8	3·2	8·7
1969	9·3	3·5	14·4	6·0	11·3	7·8	3·1	7·7
1971	9·1	3·0	15·6	5·8				
1973	9·4	3·1	15·2	5·2				

By contrast with the situation in the industrialized countries, in the developing countries iron and steel's share of total exports of industrial products increased. At the beginning of the Seventies the share of developing countries in world exports of iron and steel products amounted to only 3 % however (1 % in 1955). In the industrialized countries of the West this percentage decreased from *c.* 87 to *c.* 83 % whilst in the countries of the Soviet bloc, which were considered separately, the figure increased from 13 to 15 %. We shall consider the development prospects later.

In what follows, we shall first take exports, subdivided by regions and countries. For this purpose the following subdivisions, which take into account both economic and trading policy viewpoints, were chosen:

1. Rest of Western Europe:

   Austria, Finland, Sweden, Norway, Spain, Portugal, Switzerland.

2. Mediterranean:

   Egypt, Israel, Syria, Lebanon, Algeria, Morocco, Tunisia, Libya, Turkey, Greece, Cyprus, Yugoslavia.

3. Eastern Europe:

   Russia, Poland, Czechoslovakia, Hungary, Rumania, Bulgaria, Albania, German Democratic Republic.

4. Africa:

   excluding North Africa and the Republic of South Africa.

5. Asia:

   excluding Japan and the People's Republic of China.

6. North America.

7. Latin America.

8. Oceania.

9. Japan.

10. People's Republic of China.

11. Republic of South Africa.

As can be seen from the tables below, all regions or countries studied, with the exception of North America, registered a slight increase in exports as compared with production. Apart from insignificant quantities, Latin America, Asia, the People's Republic of China and Africa did not engage in export. The percentage of steel production exported is highest in Japan, the Community and the rest of Western Europe. In the Mediterranean countries, South Africa and Oceania the percentage exported is also quite high. But in North America and Eastern Europe it is quite low. Steel production in both regions is substantial but is sold almost exclusively for domestic use.

Steel exports as a % of production

Year	ECSC	Rest of Western Europe	Eastern Europe	North America	Latin America	Japan	People's Republic of China	Asia	Africa	Medi-terranean countries	South Africa	Oceania
1955	14·4	13·9	2·9	3·3	—	21·4	—	—	—	1·0	—	1·6
1960	15·0	18·1	1·8	3·5	—	10·8	—	—	—	9·8	7·5	5·4
1965	18·1	16·3	2·7	1·7	—	23·9	—	—	—	5·9	—	3·1
1970	10·5	17·4	4·4	5·5	—	19·3	—	4·7	—	9·4	10·0	14·2
1971	18·8	22·5	4·4	2·0	—	27·9	—	—	—	8·9	6·7	5·2
1972	17·9	16·5	4·5	1·9	—	23·3	—	1·6	—	9·1	12·2	12·0

Steel imports as % of consumption

Year	ECSC	Rest of Western Europe	Eastern Europe	North America	Latin America	Japan	People's Republic of China	Asia	Africa	Medi-terranean countries	South Africa	Oceania
1955	3·7	41·8	0·8	0·7	58·3	0·9	21·8	61·7	95·1	62·1	14·8	34·0
1960	3·2	33·2	2·8	2·6	40·4	1·2	3·8	49·4	92·0	59·0	6·7	22·2
1965	2·7	40·1	0·8	8·0	29·0	0·2	4·4	43·0	90·0	52·2	23·6	18·0
1970	7·3	30·3	1·7	7·9	25·1	0·1	11·5	46·8	86·2	54·3	9·3	12·5
1971	7·0	32·6	1·7	12·7	28·8	0·1	13·7	51·9	90·9	58·0	16·5	16·6
1972	6·0	31·7	2·0	10·9	25·5	0·1	8·7	52·6	88·4	57·1	3·4	12·4

Steel exports from the Community, subdivided by country and region

(thousand metric tons crude steel)

Year	Rest of Western Europe	Medi-terranean countries	Eastern Europe	Africa	Asia	Japan	People's Republic of China	North America	Latin America	South Africa	Oceania	Total
1955	3·036	1·363	353	874	1·462	3	5	711	1·440	170	896	10·494
1960	3·290	1·797	1·811	745	2·095	131	447	1·905	1·893	83	486	14·689
1965	6·293	1·776	573	889	1·894	4	249	6·343	1·576	707	354	20·657
1970	6·308	1·909	1·221	952	1·662	4	459	5·734	1·215	158	223	19·845
1971	5·784	2·159	1·411	1·115	1·811	1	342	9·524	1·274	417	169	24·024
1972	6·701	2·558	2·012	849	1·909	5	426	8·592	1·551	89	103	24·795
1973	6·807	3·372	3·692	995	2·167	5	689	7·293	1·884	324	144	27·372

Steel imports into the Community, subdivided by country and region

Year	Rest of Western Europe	Medi-terranean countries	Eastern Europe	Africa	Asia	Japan	People's Republic of China	North America	Latin America	South Africa	Oceania	Total
1955	513	0	139	0	0	49	0	1·678	0	0	6	2·385
1960	1·079	51	329	0	0	4	0	1·266	0	5	22	2·756
1965	1·461	39	786	0	0	190	0	134	0	0	19	2·629
1970	2·670	132	2·054	0	14	1·220	0	3·533	0	51	115	9·790
1971	2·971	59	1·790	0	0	2·430	0	586	0	35	7	7·878
1972	4·247	510	2·414	3	0	2·118	0	891	35	184	169	10·571
1973	4·082	497	2·208	13	178	1·604	0	596	244	197	282	9·901

The steel imports/steel consumption ratio has risen noticeably, above all in North America, but also in the Community. There has been a marked decrease in the ratio in Latin America, owing mainly to the speed at which additional production capacity has been installed. In spite of this in abolute quantities imports have still grown. In fact they rose from 3·3 million metric tons of crude steel in 1955 to 5·3 million metric tons in 1972. For the rest of Western Europe, too, the import percentage decreased from 41·8 to 31·7 % during the same period but, again, the absolute figure for imports increased from 3·5 to 8·6 million metric tons of crude steel.

In Asia, Africa and the Mediterranean countries, the percentage imported decreased but still amounts to over 50 % of steel consumption. In these regions too the volume of imports in absolute terms has grown.

Without doubt, this is an interesting phenomenon: in spite of a healthy increase in steel production, the import requirements in Latin America, Asia, Africa, Mediterranean countries and the rest of Western Europe have risen. In fact in absolute terms steel consumption has increased more than production. The percentage increase in steel consumption is lower than the percentage increase in production since steel consumption is expanding from a higher base than production. If the faster percentage rate of growth in steel production continues in the rest of Western Europe and Latin America in the 80's, production could catch up with consumption. This does not necessarily mean that imports will decrease. The example of the Community and North America shows that, but for some exceptions and despite the coverage of total steel consumption by domestic production, imports increased in a free steel market for reasons which could hardly be explained by lack of production capacity but which are explained by factors such as commercial networks, differences in prices, delivery periods and qualities.

The largest proportion of Community exports go to North America and the other countries of Western Europe. These countries are followed in descending order by the Mediterranean countries, Eastern Europe, Asia and Latin America. Africa and Oceania play a very minor part. Imports into the Community come mainly from the rest of Western Europe, Eastern Europe, Japan and North America. The large increase in imports from Japan and the decrease in imports from North America are particularly noteworthy.

As regards distribution of world trade in steel by product groups, there has been an increase in the proportion of flat and semi-finished products, whilst the proportion of non-flat products has decreased noticeably. The same trends can be seen in Community trade.

Percentage of various product groups in world steel trade

Year	Flat products		Non-flat products		Ingots and semi-finished products	
	World	Community (1)	World	Community (1)	World	Community (1)
1953	42·2	32·2	50·6	58·8	7·2	9·0
1956	44·5	39·2	45·2	56·1	10·3	4·8
1960	49·7	42·3	38·3	48·9	12·0	8·8
1964	49·9	44·0	37·3	47·2	12·8	8·8
1968	52·8	47·1	32·1	39·7	15·1	13·2
1972	58·2	48·6	28·9	36·6	12·9	14·8

(1) Exports.

The Community was at some time a net exporter of ingots and semi-finished products as well as of the other two product groups; for the past few years, however, it has been a net importer.

The Community's share of world steel trade has decreased from 48 % in 1964 to 38 % in 1972; since 1970 the decline has halted. In fact the situation would appear to have almost stabilized. The falling-off was particularly noticeable in trade with Asia and Latin America. In the rest of Western Europe and Eastern Europe, however, the share of Community exports in total steel imports has remained almost unchanged (78 and 60 %).

As with the Community, the proportion of world trade accounted for by North America and the rest of Western Europe has decreased. Japan's share, however, has increased. North America has taken a larger share in world steel trade only when as a result of a boom, export prices have become advantageous. Eastern Europe has been an irregular exporter to the Community; during periods of recession, this area has always put large quantities on the market whilst, during periods of boom, when it would have been possible to import larger quantities, it has hardly tendered for any business. The same is true for imports from Japan.

Market shares of world steel trade in %

Year	Community	Japan	North America	Rest of Western Europe	Eastern Europe
1964	48·5	21·6	10·7	7·4	10·1
1966	50·8	27·0	4·2	6·6	9·6
1968	47·2	27·7	4·5	6·8	10·6
1970	35·0	31·7	12·6	6·1	12·1
1972	38·2	34·7	3·9	5·6	11·6

Having so far analysed mainly the structural developments, we now turn to the fluctuations in the trade cycle.

The following table shows that there are considerable annual fluctuations in both exports and imports. The highest annual rate of change for exports was 37 %, and for imports 78 %. At times the fluctuations in export prices were even greater, namely a 102 % maximum for merchant bars and 48 % for cold-rolled sheet. These annual rates of change naturally also reflect trends in long-term growth, but the peaks and troughs clearly demonstrate the enormous effect of fluctuations in the trade cycle. The results for 1974 were exceptional because of a shortage of steel on certain world markets.

Percentage changes compared with the previous year

Year	Exports of the Community	Imports of the Community	World market prices: Merchant bars	World market prices: Cold rolled sheet
1964	+ 12·2	+ 11·7	+ 15·4	+ 15·5
1965	+ 36·8	— 28·8	— 2·2	— 18·1
1966	— 10·8	+ 14·9	+ 5·7	+ 1·9
1967	+ 12·3	+ 28·2	— 6·0	+ 0·1
1968	+ 8·3	+ 15·7	± 0	+ 6·5
1969	— 10·8 (1)	+ 78·1	+ 37·2	+ 27·2
1970	— 0·8 (1)	+ 22·6	+ 14·0	+ 9·0
1971	+ 12·1	— 19·6	— 11·5	— 16·5
1972	+ 3·3	+ 26·1	— 6·7	+ 1·5
1973	+ 10·7	— 2·9	+ 30·6	+ 23·8
1974	+ 25·2	— 22·5	+ 102·2	+ 48·3

(1) The decline in exports in the 1969/70 boom was due to insufficient production capacity at the time.

As a conclusion to our analysis we shall briefly consider indirect external trade in steel, in which we take indirect external steel trade to mean steel used in the manufacture of exported or imported products.

The table given below shows indirect steel exports have increased even during periods of general market recession. Indirect steel exports therefore exhibit a more stable trend than direct steel exports. In addition it can be seen that net indirect exports of steel have increased at a faster rate than direct net steel exports. This result tallies with the comment made above, namely that the proportion of exports of iron and steel products in the total of exports of industrial products has decreased.

Direct and indirect foreign trade in steel of the six original members of the Community

(million metric tons crude steel)

Year	External direct steel trade			External indirect steel trade		
	Exports	Imports	Net exports	Exports	Imports	Net exports
1965	18·6	2·5	16·1	12·3	2·4	10·0
1966	16·2	2·9	13·2	12·6	2·3	10·3
1967	18·6	3·3	15·3	13·3	2·2	11·4
1968	20·1	3·8	16·2	15·3	2·9	12·4
1969	18·3	6·4	11·9	16·7	3·1	13·6
1970	17·7	8·5	9·2	17·1	3·9	13·2
1971	20·7	6·6	14·1	19·2	4·9	14·3
1972	22·7	8·2	14·5	22·8	5·1	17·7
1973	23·6	7·5	16·1	22·1	5·0	17·1
1974	34·5	5·1	29·4	n. a.	n. a.	n. a.

(Figures in brackets = the enlarged Community)

B — *FORECAST OF EXTERNAL TRADE IN STEEL IN 1980 AND 1985*

The future trend of the Community's external trade in steel will depend not only on the competitivity of the Community steel industry but also on the pace at which world trade expands and the economic policy measures affecting trade taken in various quarters.

To analyse competitivity we must take into consideration the production plant, the available manpower, supplies of energy and raw materials and also measures to protect the environment.

As regards the production plant of Community steel works, it is quite clear that the progressive replacement of obsolete plants has enabled all stages of production to be increasingly modernized to a greater or lesser degree, instead of having old and new equipment side by side in the same works as often happened in the past. Modernization has had a favourable effect on the flow of material, methods of operation and quality of products. Taking into account in addition that new works have also been built there, the Community is in a better position than in the Fifties and Sixties as regards production plant. A number of emerging iron and steel producing countries, mostly with new equipment, had an advantage in terms of productive apparatus and hence processing costs at that time. It is uncertain whether or not this disadvantage has been fully eliminated, but it has certainly been reduced.

Obviously it takes longer to completely modernize existing works, than to construct new works of the same size. There are many reasons for this: tradition, lack of space in existing works, planning difficulties, consideration of existing social and economic structures, the existence of production plants which makes the construction of new works less urgent than in places where there are no such capacities, etc. As the emerging industrial countries were not faced with these problems they had a temporary advantage. Of course additional factors favoured the development of the steel industry in some of these countries, for example favourable locations, administrative measures and attractive financing facilities.

Labour costs per ton of rolled steel are likely to increase in the steel industries of almost all developed industrial countries. The reason for this is that the steel industry is one of the sectors in which the rate of growth in productivity is progressively declining, whereas wage increases are in line with the average for all sectors and are therefore in excess of productivity increases. Thus, since the end of the Sixties average wages in the Community steel industry have risen more than productivity. One could conclude from this that the developing countries where wages are low conditions would be more favourable. However, this way of looking at the matter does not take into account the complexity of iron and steel technology resulting from the great speed at which vast quantities of materials are processed into products of the highest quality. As a result of this complexity, all categories of qualified manpower are required at almost all stages of the production process, and such manpower is rarely available in developing countries whose economy is based on agriculture or at best craft industries. Certainly the most up-to-date production equipment is being installed in developing countries, but in view of the severe demands as regards handling the complicated technical equipment of the iron and steel industry, manpower training remains a serious problem. In addition, there are often no local ancillary industries to cope with major repairs, or the replacement of plants, and these services have to be provided by industrial countries situated thousands of miles away. As a result, works have to be shut down. In view of the high overheads, this represents a considerable financial burden and the level of utilization of equipment is much lower than in the industrial countries. The competitivity of developing countries will certainly remain adversely affected by this for some considerable time.

As regards the impact of the rise in energy prices on the competitivity of the steel industry, suffice it to say that, in the long term, countries which have their own cheap energy resources will be in a better position than countries which have to buy energy at prices far in excess of production costs.

Thus, in all probability the USA and USSR will derive some advantage from having their own energy resources whereas the Japanese steel industry will be at a disadvantage in view of its great dependence on energy imports. Unless there is a change in the supply situation this disadvantage is likely to persist. The Community steel industry does not possess the same internal supply facilities as the USA and the USSR, nor is it as dependent on imports as the Japanese steel industry. As a result, its position in terms of competitivity lies between its major competitors.

Lastly, as regards the supply of raw materials, conditions of supply in the Community have improved as a result of the increase in the proportion of ore imported from non-member countries and also the increased development of sites which are favourably situated in terms of transportation for these ores. An advantage exists also for those countries who possess their own cheap supplies of mineral raw materials. For a number of years there has been a clear tendency for the Community steel industry to move towards the coast. The production potential of coastal works as compared with the total production potential of the Community in its original composition rose from 13 % in 1965 to 22 % in 1975. In addition, the expansion of inland sites has developed most quickly in places where there is a suitable waterway link with the coast. For example, the share of the western part of the Ruhr in the productive capacity of North Rhine-Westphalia as a whole has increased. The steel industries of all the countries of the Community have, in one way or another, expanded their activities in coastal locations or on stretches of major waterways near the coast more strongly than in other locations and in so doing helped to improve their competitivity. There is a tendency for works located inland to specialize above all in long products and quality products. These trends are likely to continue in the years to come. Furthermore, there could be a change in the supply of raw materials on the world market with the result that in addition to crude ore there would be an increasing supply of processed ores in the form of pellets and sponge iron and eventually semi-finished products. This change would affect competitivity.

However, in addition to competitive prices, a precondition for importing these products is that there should be an adequate guarantee of long-term supplies. Many countries with rich ore and energy reserves are increasingly endeavouring to process these resources themselves: for example countries with sources of cheap energy, such as Iran, Algeria and Venezuela, and those with rich iron ore reserves, such as Brazil, Sweden, South Africa, and Australia. In a few cases (Venezuela, Australia and South Africa) there are reserves of high-quality ore not too far from the energy sources. In the long term these countries are likely to play a more important role not only as suppliers of raw materials but also as exporters of rolled steel products.

For a number of years the cost of protecting the environment has been an increasingly important factor in competitivity. This expenditure is also a major factor in other leading industrial countries (Japan and the USA). The consequences of environmental protection are particularly serious in cases where technical progress is hampered or the building of new works is made impossible, as has already happened. The outcome of this situation could be that in future the steel industry will turn its attention increasingly to the importation of processed raw materials and the possibility of transferring part of production overseas at a later stage.

Let us now turn our attention to the prospects for general economic growth in industrial and developing countries and examine the general outlook as regards steel production and consumption.

It has already been mentioned in the analysis of steel consumption in the Community that there has been a marked change in the trend of economic activity as a result of intensifying inflation, increases in the cost of energy, the worsening of the balance of payments disequilibria and the instability of the international monetary system.

In some areas there are also social problems which have been accentuated partly as a result of the rapid increase in inflation.

The same problems are affecting economic growth in almost all other industrial countries. The same applies to the developing countries or at least those that do not have energy or raw material reserves which they might have been able to exploit in order to benefit from price increase. Consequently, the conditions for economic development are unfavourable in many parts of the world. For this reason, apart from a few exceptions such as the oil-producing countries, a certain amount of pessimism has been exercised in forecasting world steel consumption. Account has also been taken of the fact that the developing countries — not least as a result of aid and cooperation measures by industrial countries — are taking the first steps towards industrialization and more rapid economic development could result.

The question of the stage in this industrialization process at which the countries concerned should develop their own steel production plants has been discussed on many occasions. It has been pointed out quite rightly that the standard production process with blast furnaces and oxygen converters would entail for too much capital expenditure for these countries and comparatively few jobs would be created. In addition, plants of this kind must be of very large capacity if they are to be fully viable. Such a capacity is much greater than the demand of many developing countries. As a result it would seem more appropriate for these countries to use the direct reduction process, followed by electric furnaces and continuous casting plants which are viable at considerably lower capacities and require less capital expenditure. However, because of the complexity of modern iron and steel technology a great deal is demanded of the work force. Consequently, an intensive training process is necessary before these countries can operate steel production plants successfully. Another prerequisite is the creation of suitable infrastructures and the development of efficient marketing organizations.

In most developing countries which are building up their own steel industry, steel consumption expands more quickly in absolute terms than production in the first sometimes long phase. As a result more steel has to be imported. This is of particular importance when forecasting the Community's future export trade in steel. Not until a later stage does steel production begin to close the import gap to an increasing extent, until an exportable surplus is achieved, this being initially restricted to a few products, while other products still have to be imported. In theory, the same observations apply to the emergent industrial countries. Hence the development of domestic steel industries in developing countries and emergent industrial countries need not entail a drop in Community steel exports. Taking into account in addition that imports of all types of equipment required for industrial development also represent (indirect) steel exports there are two different ways in which international trade in steel can expand.

In order to draw up forecasts for Community trade in steel with non-member countries and to set the targets for exports in the period 1980 to 1985 consideration must also be given to recent developments in commercial policy.

To open this part of the chapter we therefore propose to bring out the more important aspects.

First of all, it must be stated that, although apart from a few exceptions the ECSC Treaty does not limit the prerogatives of the national governments as regards commercial policy, they have undertaken several common commercial measures in the area of iron and steel products.

In relations with State-trading countries, there has been since 1963 a common import quota system in accordance with an inter-governmental agreement concluded at a time of substantial increase in imports from these countries and sharp falls in prices (mainly due to the Community undertakings aligning their prices on offers from State-trading countries).

In the subsequent years this system was expanded and improved, in particular with a ban on Community undertakings aligning their prices on offers from State-trading countries. This ban was cancelled in 1973, following the improvement in the Community steel market.

Following the entry into the Community of three new member countries who had already liberalized their trade in steel products, and the substantial unilateral liberalization measures decided upon by a member country, is has not been possible, despite proposals by the Commission, to agree on a common list of sensitive products to remain subject to a quota system as regards the countries of Eastern Europe.

After 10 years of common commercial policy every State has therefore resumed its own autonomy of decision, although they have agreed to abide by a common system of consultation and have settled on a procedure for supervision and safeguard.

It should be noted however that the five member countries most concerned with imports from the State-trading countries have decided, on the proposal of the Commission, to maintain quantitative limits for 1975 on imports of the most sensitive products from these countries. For Italy and the Benelux countries the list of sensitive products subject to quotas remains the same as for 1974 whereas the list for the Federal Republic of Germany has been shortened following a series of liberalizing measures announced at the beginning of the year.

While awaiting the conclusion of commercial agreements between the Community and State-trading countries, the decisions taken by the five member countries referred to above constitute an important element, in commercial policy *vis-à-vis* countries with different economic systems and different commercial policy instruments, to ensure the smooth functioning of the Community's steel market.

Special emphasis is laid on the free trade zone agreements scheduled between the Community and several West European countries (1), in view of the impetus which they are likely to give to the steel trade between the two areas.

These countries are neighbours to the Community and by tradition have fairly close political and economic ties with it.

The details are to be found in the texts of the various agreements concluded between the Community and the individual countries in question; the following remarks simply highlight the most important aspects.

These agreements provide primarily for the progressive dismantling of duties and taxes with equivalent effect by 1 July 1977 and of quantitative restrictions and measures with equivalent effect by 1 January 1973 and 1975. Certain agreements incorporate special provisions for sensitive products. For example, in the agreements with Austria and Sweden the contracting parties have reserved the possibility of introducing up to 1 January 1980 indicative ceilings above which the duty applicable in respect of non-member countries for certain sensitive steel products may be reintroduced with, however, a clause whereby such ceilings may be suspended if in two consecutive years imports of the products in question are less than 90 % of the limit. For these sensitive products, moreover, tariffs will be removed more slowly by both parties.

All these agreements, except that with Iceland, include provisions which state that agreements and agreed practices between undertakings whose purpose or effect is to distort competition in production or trade are forbidden. The abuse of a dominant position by one or more undertakings on the territory of the contracting parties or in a substantial area thereof, and public aids which distort or threaten to distort competition are also prohibited. These regulations are in accord with Chapter VI and VII of the ECSC Treaty.

It should be noted finally that in the agreements with Austria, Sweden, Norway, Finland and Portugal, the contracting parties have agreed to accept discipline in prices similar to that provided for in Article 60 of the ECSC Treaty, assuming to this effect a free flow of information on costs of transport.

In order to prevent any undermining of the smooth functioning of the common market by differences in conditions of prices competition, the agreement with Switzerland includes a unilateral safeguard clause. This country, although it has accepted the arrangements for prices provided for in the Community, is not obliged to apply formally rules similar to those laid down in Article 60 of the ECSC Treaty.

Steel products are included among those for which the Community has autonomously granted tariff preferences since 1971 to several developing countries and territories. This system, known as generalized tariff preferences, is an important tool for aid to development which the Community was the first to offer to the countries in question. The example of the Community has been followed by nine other countries, which, however, apply varying systems, especially as regards the list of beneficiary countries.

One of the Community's longer-term objectives as regards generalized preferences is precisely that of achieving the harmonization of the variety of systems open to developing countries.

In the shorter term the Community should make improvements to its own systems, for instance by agreeing to a better use of the system by the beneficiary countries and a more equitable

(1) Austria, Finland, Iceland, Liechtenstein, Norway, Portugal, Sweden, Switzerland.

distribution of advantages among them. In the system put in force for 1975 a first stop in this direction has been accomplished.

As for most industrial products, the Community has improved the possibilities open to beneficiary countries for steel products. Thus in 1975 *ad valorem* tariff quotas for products still subject to quantitative restrictions have been increased compared with the previous year from 3·3 % to 17·7 %. However, allowing for the sharp drop in steel prices in the meantime, these increases are even more substantial in quantitative terms.

In the past some beneficiary countries have made considerable use of the possibilities offered to them concerning certain steel products.

Steel products are also the subject of an *ad hoc* agreement concluded by the representatives of the governments of the member countries in parallel with the Convention of Lomé of 28 February 1975 with 46 African, Caribbean and Pacific countries. This agreement provides for the granting by the countries in question of total exemption from duties.

Here it should be noted that some of these countries already are or will be able to gain real advantage from these concessions if they have steel undertakings or if their undertakings are in an advanced stage of construction.

To complete the picture of the Community's trade policy in the steel sector, mention should be made of the agreements already concluded, or now being negotiated or planned with several Mediterranean countries.

The agreement concluded between the Member States of the ECSC and Israel provides for a faster dismantling of tariffs by the Community (by 1977) and a slower removal of tariffs by Israel, at different rates according to the category of products (between 1980 and 1985). This agreement besides containing the typical safeguard clauses which may be invoked by both parties, provides in favour of Israel the clause known as the nascent industries clause, which allows that country to increase or reintroduce duties within certain quantities and time limits.

Negotiations which also cover steel products are now under way with the Maghreb countries, and the proposed negotiations with the Arab Republic of Egypt, Lebanon, Jordan and Syria should also include iron and steel products.

This section on trade policy cannot be concluded without a reference to the new round of multilateral negotiations under Gatt.

When adopting its overall views on 26 June 1973, the Council of the Communities laid down a series of themes and general guidelines for these negotiations.

When they approved the Tokyo declaration of 14 September 1973, the Ministers of all the contracting parties, who were prepared to take part in the negotiations, laid down the main purposes thereof.

The purpose is the reduction of customs duties according to rules to be established as well as the elimination of non-tariff measures or at least the reduction of their restrictive or distorting effects, and such measures should be subject to international discipline.

The appropriate improvements should be made to the safeguard system in order to facilitate the liberalization of trade.

It should also be noted that the Ministers have established that additional advantages should be granted to developing countries in particular, or to the least advanced among them, and that the policy of liberalization of world trade should be accompanied by parallel efforts to establish a durable and equitable monetary system.

The commercial policy measures described above will be of great importance in the coming years to the Community's external trade in steel. It will give the steel industry not only in the Community but also in the associated countries new opportunities for development which could lead to an increase in the international division of labour and should alter the course and significance of patterns of trade. For this to happen the steel industries in all the countries concerned must adapt to the changed circumstances.

We shall now examine the place that the Community steel industry could occupy in international competition. The same countries and regions referred to in the historical analysis above will be considered.

Because of their geographical proximity, the rest of Western Europe as well as Eastern Europe and the Mediterranean countries are a favourite target for Community steel exports. There are traditional trade links with the countries of Western Europe, a feature of which is the close contact not only with the steel industry but also with the processing industries in these countries.

A rapid expansion of both steel production and consumption is to be expected in all the countries of the rest of Western Europe. Per capita steel consumption (which was some 350 kg at the beginning of the Seventies) should increase noticeably in the coming years. The countries in question will be a worthwhile target for both direct and indirect steel exports since the rapidly developing industrialization of these countries makes it necessary to import capital goods.

The rest of Western Europe offers an interesting example of imports increasing continuously despite a large increase in domestic steel production. From our estimates we expect that both the export and imports of these countries will increase further. The free trade agreements concluded with almost all of them represent an important means of progressively increasing trade between the Community and the countries concerned.

Consequently, it can be expected that trade in steel will increase considerably in both directions. The Community should be able to expand its traditional exports of bars, sections and wire rod to Scandinavia and a further expansion of trade in flats should also be possible. The same goes for Austria. Spain could increasingly become a target for exports of quality steels provided that there is a reduction in the high duties on steel and the inflated import levies. In competition with their competitors, it should be possible for Community steel works to at least maintain their existing share in the total imports of the rest of the countries of Western Europe.

The remaining countries of Western Europe are not only importers of steel products, however, but to some extent exporters of long standing with traditional links with the Community. The countries with which free trade agreements have been concluded should benefit from the removal of tariff barriers. Sweden and Austria are the main exporters of special steels and both countries have acquired a leading reputation in this field of production.

Trade with almost all the major steel-producing countries of Western Europe has been placed on a new foundation as a result of common rules concerning prices and conditions of competition written into the free trade agreements. This foundation has been laid in the interest of normal competition.

In Eastern Europe steel consumption has recently been increasing more than production. A deficit has arisen particularly in the case of quality flat products, resulting in large-scale imports. It looks as if this deficit in flat products could continue in the next few years. Although considerable new capacities are being built there should be a further increase in the consumption of heavy and medium plate by tube manufacturers and the shipbuilding industry, with the result that there are unlikely to be sufficient quantities of steel available for the production of thin plate, demand for which is increasing strongly as a result of the continuously expanding production of consumer durables and cars.

It is difficult to say how long this situation will last. Certainly every effort will be made in Eastern Europe to meet requirements through domestic production in the long term. It cannot be ruled out that soon Eastern Europe will again be a major exporter of rolled steel products. If this happened the common market for steel would again be a favourite export target for the Eastern European countries. As the principle of covering costs does not play the same role in the East as it does in the West care must be taken to ensure that the common market for steel is not damaged again by cheap imports.

Fairly large Community exports, particularly of quality steels, have been assumed in the forecast for 1980, but if the market situation is normal it is not expected that exports will reach the peak of 1974. Steel imports from the Eastern Europe could again expand in comparison with the low level recorded at present. As the trend in the Eastern European countries is difficult to assess these forecasts are rather unreliable.

The Mediterranean countries represent the third group of countries bordering directly on the Community. Geographical advantages alone would make it possible for trade to be intensified but there is an additional advantage in the shape of the traditional links with these countries. Consolidating these links by means of trade and association agreements which should make it easier for these countries to work towards industrialization should also be beneficial to reciprocal trade in steel. The Mediterranean countries with oil reserves earn valuable foreign currency from energy-consuming countries and availability of funds is an additional precondition for rapid economic development. Industrialization has progressed in Yugoslavia, Greece and Turkey to such an extent that there is now a basis for further development. Consequently, the outlook for the Mediterranean countries is not unfavourable. This signifies that steel production and consumption should increase considerably in the coming years.

However, apart from a few products, steel production is unlikely to cover even internal requirements for the time being despite all the efforts to expand it. Thus, imports will probably have to increase further. It should be possible for the Community steelworks' share of the market to be kept at least at the present level, not least in view of the growth of the capacity of modern coastal works on the Mediterranean. Exports from the Mediterranean countries to the Community should remain on a fairly small scale between now and 1980.

As the Community and North America both possess capacities in excess of internal steel consumption, trade in steel between these two areas depends on the existing network of commercial links. In recent years the depreciation of the dollar has resulted in the export of steel to North America becoming less attractive. Mention should also be made of the latent threat to imports from US trade legislation which allows the American administration to introduce restrictive measures as well as practices of 'buy American'. In those cases where foreign producers have a competitive advantage and a regular trade has developed, administrative measures to control imports should not be introduced at every opportunity. The Community steel industry has established a network of firm commercial links in North America which should enable it to benefit from the expansion of this market. Consequently, there could be an upward trend in Community steel exports to North America, assuming that the Community steelworks retain their share of total North American imports. Not least because of the devaluation of the dollar there should also be an upward trend in North American steel exports to the Community.

Despite the rapid expansion of steel production in Latin America imports to these countries have increased further since the beginning of the Seventies. This trend could persist in the next few years, but should turn down in the Eighties with the result that eventually Latin America could become a permanent steel exporter. In view of the rich natural resources available and the successful steps that have already been taken on the path towards industrialization it can be expected that steel production and consumption will also expand strongly in the coming years, despite unresolved economic and social problems. The projects announced for developing the steel industry show that in the long term Latin America could be in a position to produce for the export market. The cost of raw materials and energy is lower in various locations in Latin America than in comparable works in Europe, but Europe should retain its superiority in terms of processing costs which are decisively influenced by the quality of its manpower. One can conclude from this that there could be a mutually advantageous division of labour between Latin America and Europe. Latin America would exploit its advantage regarding steel products for which the cost of raw materials and energy is a comparatively important factor and in exchange Europe would supply steel products requiring a higher degree of processing. That is not to say that Latin America will produce only semi-finished products and low-carbon steel products; we are merely indicating what appears to be a reasonable basis for trade in steel.

The forecast indicates a slight increase in Community exports in 1980. There is unlikely to be an increase in imports of semi-finished and finished products from Latin America before the end of the Seventies.

Africa's steel consumption (excluding the countries of North Africa which are being included with the Mediterranean countries, and excluding South Africa) has so far been covered mainly (90 %) through imports. There are a few projects which could boost domestic steel production but, in view of the exceptionally low per capita consumption, steel production will lag behind the growing consumption for a long time to come, at any rate if one considers the region as a whole. Since most of these countries have not even taken the first steps on the path towards industrialization and still depend almost entirely on agriculture, steel consumption is likely to remain fairly low for the time being. In countries which possess natural resources in the form of ores and energy there could be a somewhat more rapid development, as has already been observed in a few cases.

Community steel works are traditionally the main suppliers of steel products for this region. This close link could be strengthened by the fact that the Community is playing the leading role as the supplier of industrial equipment required for an industrialization in these countries.

The countries of the Middle East and Asia (excluding the People's Republic of China and excluding Japan) are at various stages of development and future prospects also look varied. As already mentioned in the historical part of this paper, although steel production has increased a great deal consumption has expanded so rapidly that there has been an increasing need to import.

The best development prospects should be in those countries where industrialization can build on the traditions of old craft industries. Countries which in addition have rich natural resources will have additional opportunities for economic development. The cooperation of the industrial countries through the provision of modern technology is an important factor but will attain its target only if workers in the developing countries can be trained to the level required for industrialization. Consequently, future steel exports to these countries depend not least on how the Community sets about supplying capital goods for the industrialization of these countries and helps to provide training.

Steel production in these countries will certainly experience a substantial growth but, in view of the great population density in these regions, the potential demand for steel products is enormous such that import requirements as a whole should increase further. Consequently, the countries of the Middle East and Asia represent a promising market which should be worth cultivating. Steel exports to these countries could show a sharp rise between now and 1980 and even thereafter. In the medium-term, the oil-producing countries should offer a sizeable market in view of the rapid growth that can be expected in their direct and indirect consumption of steel. Apart from occasional deliveries the volume of steel imports from this region between now and 1980 is unlikely to be large. In the longer-term Iran in particular could gain ground as a supplier of sponge iron and semi-finished products and perhaps even small amounts of finished steel products. Like the South American countries, the Asian countries with old craft industries have the best development prospects.

Community steel exports to the other countries and regions, the People's Republic of China, Japan, Oceania and South Africa, are comparatively small and fluctuate considerably. Estimates of exports to the People's Republic of China can be little more than speculation. In recent years a rather more regular trade seems to have developed, but it is difficult to predict how long this will last. The demand for steel in countries experiencing rapid industrial development is so large that even where intensive efforts are made to increase demestic production steel must be imported to cover the deficit. Perhaps this also applies to the People's Republic of China. A slight increase in Community exports is therefore considered likely.

Community steel exports to Japan have so far amounted to only a few thousand metric tons a year. It could be advantageous to increase these exports but this would require opening up the market. Hitherto it has been reserved almost exclusively for the domestic steel industry.

There is also unlikely to be a significant increase in exports to Oceania in the coming years. The major steel consumer, Australia, has an exportable production surplus.

There are considerable fluctuations in exports to South Africa as they serve mainly to cover occasional deficits. As production conditions are comparatively good import requirements are unlikely to increase.

Both Australia and South Africa export steel to the Community and could in future gain ground as suppliers of sponge iron and semi-finished products.

On the basis of these considerations world steel consumption (or production) has been estimated at 892 million metric tons (including the Community) in 1980 compared with 625 million metric tons in 1972. In the same period world trade in steel should rise from 65 to 92 million metric tons, with Community exports increasing from 25·0 to 35·5 million metric tons and Community imports from 10 to 11 million metric tons. (All the figures are for crude steel; no allowance is made for crude steel saved in the continuous casting process.).

The share of the exports of the Community in world steel trade was 38·2 % in 1972 (38·6 % taking into account the influence of the continuous casting process).

The figures for exports and imports in 1980 are 33 million metric tons and 10 million metric tons respectively. This gives net exports of 23 million metric tons compared with 27 million metric tons during the export boom in 1974 and 17·5 million metric tons in 1973. This estimate for 1980 presumes a normal trend. If the trend is unfavourable exports could total 32 million metric tons and imports 10 million metric tons, yielding net exports of 22 million metric tons. In an exceptionally favourable situation exports could amount to 37 million metric tons and imports 10 million metric tons, with net exports amounting to 27 million metric tons of crude steel. (The figures take into account the influence of the continuous casting process).

The world market for steel, assuming a normal trend

(in million metric tons of crude steel)

	1972	1980	1985
World steel consumption	625	892	1040
World trade in steel	65	92	120
Exports from the Community	25	33 (35·5)	37 (39)
Imports into the Community	10	10 (11)	14 (15)

(Figures in brackets do not take into account the influence of continuous casting on crude steel demand)

As regards the breakdown of external trade in steel according to product groups, the trend mentioned in the historical part of this paper is likely to continue but will probably be less pronounced. In other words, there will be an increase in the proportion of flat rolled products in total exports. In making this estimate it was assumed among others that productive capacity for flat products in the Community will increase more slowly than for long products in terms of percentages between now and 1980.

Net Community exports (in 1 000 metric tons of rolled steel)

Products	1966	1973	1980
Raw ingots and semi-finished products	722	— 446	— 2 400
Hot-rolled coils	— 59	— 110	— 400
Light and heavy sections	4 422	4 611	6 700
Wire rod	793	1 381	2 300
Hot rolled strip	381	501	900
Heavy and medium plate (1)	1 542	1 451	2 600
Sheet, not coated	1 675	3 130	5 500
Sheet, coated (2)	1 443	2 290	3 800
Total	10 919	12 808	19 000

(1) Including universal plates.
(2) Including electrical sheets.

In view of the many uncertain factors involved, this forecast in terms of product groups is a hypothetical one.

In examining the prospects for 1985 it must be taken into account that some emergent producing countries (in particular Brazil, Venezuela, Iran, Australia and South Africa) could supply not only sponge iron and semi-finished products but also not insignificant quantities of rolled steel finished products. We have already mentioned that Sweden intends to export semi-finished products. Australia and South Africa are already steel exporters of long standing. The Community could increase its import of semi-finished products in particular. The main importing works would be those for which the costs of carriage of raw materials are excessively high, for which costs are increasing too much or whose plans to extend melting facilities are hampered as a result of environmental protection.

The precondition for importing semi-finished products is that this can be done cheaply, that the importing steel works are able to hold their own in competition and that there are adequate guarantees of long-term security of supplies. Imports of semi-finished products are likely to be restricted to ordinary types, since in the case of special steels which are often manufactured to order there must not be too great a distance between the place where the semi-finished products are manufactured and where they are rolled out, partly because of the time taken to supply semi-finished products from overseas and partly because of the difficulty of establishing contact between producers and consumers.

These overseas countries will probably also increase their share of the world market for finished rolled-steel products between now and 1985. By participation in the steel industry in these countries, the Community steelworks could not only guarantee the sale of semi-finished products but also supply part of the world market for rolled steel finished products. As the Community has to import most of its raw materials and energy supplies over long distances, and equally long distances are involved in exporting finished products overseas, the question arises whether or not the Community is doing the right thing in the long term by producing low-quality products for regions which have the advantage as regards the cost of raw materials and energy. Although the Community is deficient in raw materials and energy it is rich in high-qualified manpower in comparison with many other countries. For this reason it should put the emphasis on production which makes the best possible use of this advantage. In the case of steel this would entail an increase in exports of quality products including special steels, which require greater expenditure in terms of skilled manpower. The build-up of capacity overseas will primarily serve to satisfy steel consumption outside Europe. In many parts of the world steel consumption is still exceptionally low, but is likely to increase more strongly than in the countries of the Community which are already highly industrialized. It is particularly difficult to quantify the influence of all these factors and make a fairly realistic estimate for 1985. For this reason we are merely indicating the trend. It should be mentioned in this respect that net exports in 1985 could remain at the same level as in 1980 although both exports and imports will be somewhat higher.

However, as already indicated in the historical part of this paper, indirect steel exports should continue to rise since it is to be expected that exports of industrial finished products will expand further.

The forecasts for the Community's external trade in steel made in this chapter are targets which appear attainable in the light of recognizable trends but which will require the cooperation of all concerned.

The forecasts have been narrowed down as far as possible. The margins of error would have been too great if they had been made any more precise. Moreover, the estimates for 1985 will be analyzed in greater detail in the next General Objectives — Steel.

CHAPTER III

EQUILIBRIUM BETWEEN DEMAND AND SUPPLY OF STEEL

A — *DEMAND*

From the preceding chapters on inland demand and external trade we arrive at a crude steel production, taking into account continuous casting, of 170 million metric tons under average market conditions and 183 million metric tons at the upper limit for 1980.

Crude steel balance 1973, 1980 and 1985

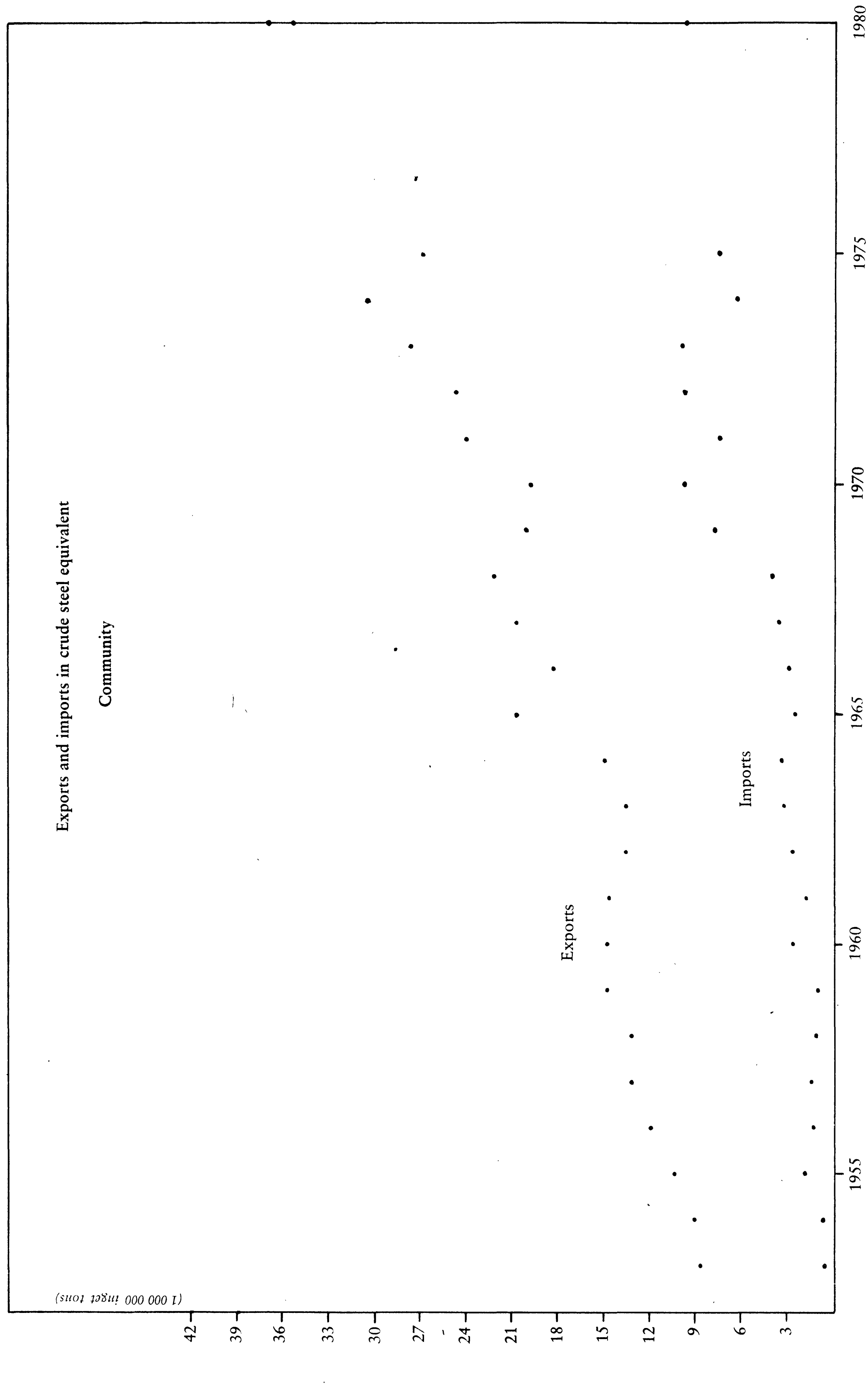
(million metric tons)

	1973	1980		1985
		average conditions	upper limit	average market conditions
Consumption	130·5	147·5	156·5	165·5
Stockbuild	+ 2·1			
Export	27·9	33·0	37·0	23·0
Import	10·0	10·0	10·0	
Scrap consumed in rolling mills	0·4	0·5	0·5	0·5
Crude steel production	150·1	170·0	183·0	188·0
(Crude steel production without continuous casting)		(180·0)	(194·0)	(204·0)

Attention has already been drawn to the fact that the chances of achieving the upper limit are rather low. In the case of a marked weakening in market conditions, the crude steel production could reach a level of 162 million metric tons.

The estimates for the various rolled-steel products showed a relatively strong increase for ingots for tubes and heavy plate.

On the other side the increase for sections and wire rod was relatively weak. The most important reasons for this are to be found in the differing rates of development of the most important consuming sectors.


Exports and imports in crude steel equivalent
Community
(1 000 000 ingot tons)
Exports
Imports
42
39
36
33
30
27
24
21
18
15
12
9
6
3
1955
1960
1965
1970
1975
1980

Production of rolled steel products: 1973 and 1980

(million metric tons)

	1973	1980	
		average market conditions	upper limit
Coils as finished products	8·0	8·5	9·2
Light and heavy sections	37·5	41·9	45·0
Wire rod	12·0	13·0	14·0
Strip	8·7	11·1	12·0
Heavy and medium plate (1)	15·6	20·4	21·9
Sheet	29·7	36·3	39·7
Total	111·5	131·2	141·8

(1) Includes universals.

B — *SUPPLY*

Within the Community, steel supply is normally measured in terms of 'production potential' (1). Production potential for pig iron, crude steel and rolled products means the maximum production which can effectively be achieved by all the different sections of a plant taken together, allowing for possible bottlenecks in one section holding up all the others.

Community production potential for 1980 has been established on the basis primarily of a special enquiry which was conducted among the steel enterprises during 1974 and 1975.

Unlike the figures of future production potential which are published in the ECSC annual report on investments, the figures for 1980 take into account capital projects which are at the moment only planned, as well as those which are definitely decided or in progress.

In interpreting these figures, it must also be borne in mind that recent experience shows a widening gap between the production potentials declared by the enterprises and the actual outputs achieved from one period of high activity to the next. The following factors may offer some explanation of this phenomenon:

— the average size of certain plants has increased more rapidly than total production: in 1973, 342 blast furnaces were in operation in the Community against 518 in 1960. This means that the occasional stoppage of one of them, for any reason, has more serious consequences than before on the level of production, both upstream and downstream from the plant directly concerned,

— during boom periods the full exploitation of production potential is sometimes hampered by unforeseen manpower, raw material and energy supply problems;

— to a degree which varies from region to region, a number of enterprises include in their production potential obsolete plants which they in fact use only in exceptional circumstances.

Due to these factors which prevent maximum use of declared potential, rates of utilization of 85 % to 90 % for pig iron and crude steel and 80 % for total rolled products are becoming increasingly accepted as the maximum rates achievable in practice.

Production potential for pig-iron

The production potential of the blast furnaces of the Community is expected to reach a level of 157·7 million metric tons in 1980 compared with 124·8 million metric tons in 1973. Potential will thus increase at an average rate of 3·4 % p.a. The table below gives a breakdown of this forecast by country:

(1) Maximum possible production is defined as follows: 'Maximum possible production is the maximum production which it is possible to attain during the year under normal working conditions, with due regard for repairs, maintenance and the normal holidays, employing the plant available at the beginning of the year but also taking into account both additional production from any new plant installed and any existing plant to be finally taken out of production in the course of the year. Production estimates must be based on the probable composition ration of the charge in each plant concerned, on the assumption that the raw materials will be available.

Development of pig-iron production potential by country 1973 to 1980

	Production potential million metric tons			Total increase 1973 to 1980 (1973 = 100)	% growth p. a. 1973 to 1980
	1973	1978 (2)	1980 (3)		
F.R. Germany	44·3	51·5	52·9	119·4	2·6
Belgium	14·6	16·2	20·2	138·4	4·7
France	22·7	30·0	30·3	133·5	4·2
Italy	13·9	17·3	17·5	125·9	3·3
Luxembourg	5·5	5·9	6·8	123·6	3·1
Netherlands	5·5	6·3	6·9	125·5	3·3
United Kingdom	18·3 (1)	22·7	23·1	122·2	3·4
Community	124·8 (1)	149·9	157·7	125·8	3·4

(1) Revised figure for United Kingdom.
(2) Arising from projects already in progress or decided. Source ECSC Investment Survey 1975.
(3) Arising from projects in progress, decided and planned.

The largest percentage increases in potential are expected to be installed in France and Belgium. However, with the exception of two projects planned in Belgium and the United Kingdom, the figures do not include any major expansion of blast furnace capacity which was not already decided on by the end of 1974.

A number of enterprises — notably in the United Kingdom — have announced extensive programmes for the replacement over the next five years of existing blast furnaces which have become obsolete.

Comparison with the figures for crude steel production potential shows that in 1980 at most 691 kg of pig iron would be available per metric ton of crude steel compared with 718 kg in 1973. This fall in the overall ratio reflects principally the increased share of the electric process in total steelmaking potential, which is announced by the enterprises.

Production potential for crude steel

The table below gives figures of Community crude steel production potential by country and by process together with the figures for production potential in 1973 and 1974.

Community crude steel production potential by production process 1973 to 1980

(million metric tons)

	Total production potential		1980						1973 to 1980	
	1973	1974	Basic Bessemer	Open hearth	Electric steel	OBM/LWS	LD and others	Total	Index 1973 = 100	% growth p. a. 1973—1980
F.R. Germany	58·8	60·4	—	9·0	8·5	4·1	48·3	69·9	118·9	2·5
Belgium	17·3	17·8	0·4	0·1	1·5	4·4	19·0	25·4	146·8	5·6
France	28·1	30·5	—	1·9	6·3	9·9	22·3	40·4	144·0	5·4
Italy	28·1	28·9	—	0·4	18·5	2·6	16·5	38·0	135·2	4·4
Luxembourg	6·5	6·7	0·6	—	0·0	0·8	6·5	7·9	121·7	2·8
Netherlands	6·1	6·1	—	0·1	0·4	—	7·9	8·5	139·4	4·9
United Kingdom	28·9	27·8	—	2·5	10·6	—	23·3	36·4	126·0	3·4
Denmark and Ireland	0·7	0·7	—	0·5	1·1	—	—	1·6	228·7	12·5
Community	174·5	178·9	1·0	14·5	46·9	21·8	143·8	228·0	130·5	3·9

According to the figures, crude steel production potential will increase from 174·5 million metric tons in 1973 to 228·0 million metric tons in 1980. (As indicated above, the level of production which is actually achievable will be somewhat lower than the level of declared production potential).

Between 1973 and 1980 the average rate of increase of crude steel potential is thus expected to be 3·9 % p.a. for the Community. This rate of 3·9 % p.a. for the Community is lower than the 4·4 % p.a. increase announced in the 1975 investment survey for the period 1974 to 1978. Moreover, this survey gave a predicted crude steel production potential of 212·8 million metric tons in 1978 stemming from projects which were already decided or in progress. The forecasts for 1980, which include planned schemes, thus add 15 million metric tons to annual production potential between 1978 and 1980, at a rate of increase of 3·5 % p.a.

Development of crude steel production potential by country — 1973 to 1980

(million metric tons)

Country	Production potential		
	1973	1978 (1)	1980 (2)
F.R. Germany	58·8	67·1	69·9
Belgium	17·3	21·1	25·4
France	28·1	37·8	40·4
Italy	28·1	37·0	38·0
Luxembourg	6·5	7·1	7·9
Netherlands	6·1	7·7	8·5
United Kingdom	28·9	33·8	36·4
Denmark and Ireland	0·7	1·2	1·6
Community	174·5	212·8	228·0

(1) Arising from projects already in progress or decided. Source: ECSC Investment Survey 1975.
(2) Arising from projects in progress, decided and planned.

The breakdown of crude steel production potential by country in 1980 will be broadly similar to that in 1973, with the exception that Belgium, France and Italy will each gain a slightly larger proportion of the total, and the Federal Republic of Germany a somewhat smaller proportion.

The highest rate of increase in potential — of an average 5·6 % p.a. — will occur in Belgium where a major expansion of a steelworks is being planned. Production potential in France, the Netherlands and Italy will also continue to grow relatively rapidly, while that in the United Kingdom is expected to increase at an average 3·4 % p.a. — substantially faster than in the past.

The following table shows the expected growth of production potential from 1973 to 1980 at integrated coastal works in comparison with other works (1). It shows that integrated coastal works will account for **31 % of total Community crude steel production potential in 1980 as opposed to 24 % in 1973.**

(1) Bremen, Hamburg, IJmuiden, Zelzate, Dunkirk, Mondeville, Fos-Mer, Cornigliagno Piombino, Bagnoli, Taranto, Hunterston, Llanwern, Port Talbot, Ravenscraig, Redcar/Teeside, Scunthorpe.

Growth of production potential at integrated coastal works and other works from 1973 to 1980

(million metric tons)

	Crude steel		Continuous casting		Coils	
	1973	1980	1973	1980	1973	1980
Integrated coastal works	42·2	71·1	5·5	20·5	26·1	41·6
Other works	132·2	156·9	13·6	45·2	28·3	32·3
Total	174·5	228·0	19·1	65·7	54·4	73·9

For the period 1971 to 1974, crude steel potential at coastal works grew at around 13 % p.a. as opposed to about 3 % p.a. elsewhere. Potential at coastal works will continue to grow at a far higher rate than at other works (7·7 % p.a. as against 2·4 % p.a.). However the gap between the two rates of expansion will clearly narrow significantly.

This new trend may be attributed to three main factors: on the one hand, the absence of or delay in new major projects on the coast and on the other hand, the expansion of electric steelworks and modernization of other works on inland sites.

The development of production potential from 1973 to 1980 across the regions is shown in the table below. With the exception of Belgium, the regions where the largest absolute increases in potential are forecast are North Rhineland Westphalia (5·8 million metric tons), inland Italy (5·4 million metric tons), Northern England (4·4 million metric tons) and coastal Italy (4·4 million metric tons). The combined share of the Saar, Luxembourg and Lorraine regions in total crude steel production potential is expected to fall from 17·2 % in 1973 to 15·2 % in 1980.

Total crude steel production potential by region

	1973	1978 (1)	1980 (2)
GERMANY			
North	10·2	12·5	14·4
N/W	37·8	42·3	43·6
South	2·7	3·3	2·9
Saar	8·1	9·0	8·9
Total	58·8	67·1	69·8
BELGIUM	17·3	21·1	25·4
FRANCE			
East	15·5	16·6	18·2
North	9·6	13·5	13·7
Other	3·1	7·7	8·5
Total	28·1	37·8	40·4
ITALY			
Coastal	15·3	20·2	19·6
Other	12·8	16·8	18·4
Total	28·1	37·0	38·0

	1973	1978 (1)	1980 (2)
LUXEMBOURG	6·5	7·1	7·9
NETHERLANDS	6·1	7·7	8·5
UNITED KINGDOM			
Scotland	3·5	3·8	4·0
Wales	9·0	9·5	10·6
Northern England	12·8	16·5	17·4
England—other regions	3·6	4·0	4·4
Total	28·9	33·8	36·4
DENMARK AND IRELAND	0·7	1·2	1·6
COMMUNITY	174·5	212·8	228·0

(1) Arising from projects already in progress or decided. Source: ECSC Investment Survey 1975.
(2) Arising from projects in progress, decided and planned.

The technical and financial advantages to be gained in large steelworks based on the oxygen process appear to continue to encourage a number of enterprises within the Community to increase plant size.

In 1973, there were 14 plants within the Community which accounted for 60 million metric tons of crude steel production potential. In 1980, the same 14 plants will have a total production potential of 86 million metric tons, with each plant having a production potential of four million metric tons or over. Of the 61·3 million metric tons net increase expected in oxygen steel potential between 1973 and 1980, over 40 % will occur in these 14 largest plants in the Community.

At the same time, some 20·5 million metric tons increase in steel potential will be achieved in electric steelworks whose individual capacities rarely exceed 600 000 metric tons p.a.

The following table gives a breakdown of crude steel production potential by process:

Community crude steel production potential by production process 1973 to 1980

(million metric tons)

Production process	1973	Share	1980	Share	1973 to 1980 % increase p.a.
Bessemer	14·9	8·5	1·0	0·4	decrease
Open hearth	28·9	16·6	14·5	6·4	decrease
Electric	26·4	15·1	46·5	20·6	+ 8·6 %
LD and others	97·8	56·1	143·8	63·0	+ 5·8 %
OBM	6·5	3·7	21·8 (1)	9·6	+ 18·8 %
Total	174·5	100·0	228·0	100·0	+ 3·9 %

(1) Of which 7·1 million metric tons p.a. is accounted for by newly built steelworks.

By 1980 plants based on the Bessemer process are almost all expected to have been closed down or replaced by oxygen steel plants.

On the other hand, 14·5 million metric tons of open-hearth steel capacity is expected to be still in operation in 1980, mainly in the Federal Republic of Germany, the United Kingdom and France. The relatively heavy operating costs of this type of capacity clearly raises the question as to whether, in the absence of strong and continuing steel demand, further closures could be avoided.

With the decline of the Bessemer and open-hearth processes, the production potential for OBM and LWS steel is forecast to more than triple, and that for electric steel almost double. LD oxygen steels will also increase their share of total potential, rising from 56·1 % in 1973 to 63·0 % in 1980.

Production potential for continuous casting: effect on crude steel and finished product production potentials

Production potential for continuous casting is expected to rise from 19·0 million metric tons p.a. in 1973 to 65·7 million metric tons in 1980, when it will represent 28·8 % of crude steel production potential against 10·9 % in 1973 (see table).

Continuous casting: Development of production potential and share of crude steel production potential

	Continuous casting production potential (million metric tons p.a.)		% of continuous casting as % of crude steel production potential
1969 (1)		5·0	4·1
1970		6·4	5·1
1971		10·3	7·5
1972		13·9	10·0
1973	EUR-6	17·6	12·1
	EUR-9	19·0	10·9
1980	EUR-6	57·0	30·0
	EUR-9	65·7	28·8

(1) 1969 to 1972: Community in its original form.

This rapid expansion of continuous casting, which will have a substantial effect both an productivity and on scrap availability, also has considerable importance in the determination of a plant's production potential for steel and finished products.

It has been estimated that continuous casting can improve the yield of finished products from liquid steel by about 15 %. It is therefore to be expected that for a given finished product potential, the necessary steel production potential might be less.

However the returns provided by the enterprises for the period 1973 to 1980 still show a slightly higher rate of increase of crude steel production potential (3·9 %) than for finishd product production potential (3·8 %). The following table illustrates the same problem. The ratio of crude steel to finished product potential remains practically the same in 1980 as it was in 1973 despite an additional 47 million metric tons of continuous casting potential.

Ratio of crude steel to finished product production potential (1)

Year	Production potential $\frac{\text{Crude steel}}{\text{Finished Products}}$	
1964 to 1966 (2)		122·7
1967 to 1969 (2)		121·7
1970 to 1972 (2)		123·6
1973	EUR-6	122·2
	EUR-9	124·2
1980	EUR-6	122·0
	EUR-9	124·5

(1) Including coils — finished products.
(2) 1964—72: Community in its original composition.

There are several possible explanations for this result. In certain cases crude steel capacities might have to be expanded faster to cope with demands for steel for non-ECSC finished products.

Equally, in completing the special enquiry, the enterprises may have found it easier to construct forecasts for steel capacity in 1980, but have had more difficulty in forecasting either the development of individual finished product capacities or outlets for future production of semis. Finally it is possible that the enterprises have tended to underestimate the increased yields from continuous casting. To the extent that this latter factor is present in the situation, the figures for finished product production potential will have to be revised upwards, or those for crude steel production potential revised downwards.

Production potential for finished products

It is difficult to establish production potentials for finished products which can be used easily in comparisons of the supply and demand for individual products for the following reasons: first, some section mills can often make several different types of products, and it is difficult in advance to allocate the capacity between them. Secondly, some flat products can frequently be made either on specialized mills or from coils, which are slit or cut. The figures on finished product potential given here use each enterprise's own estimates of how it will allocate its capacity to the various products, or vice versa. Thus in the case where there might be an excess of demand for a product over the stated production potential, it may be quite possible to reallocate potential to it from other products.

Subject to these reservations, the estimates of the production potentials for all the finished products under ECSC definitions are given in the table overleaf.

Total finished products potential (including coils — finished products) is forecast to rise from 140·7 million metric tons in 1973 to 183·1 million metric tons in 1980. This increase represents an average growth over the seven years of 3·8 % p.a.

Community production potential for finished products 1973 to 1980

Actual production 1960 to 1973 % growth p.a.		1973	1980	Total increase 1973 to 1980 (1973 = 100)	1973 to 1980 % growth p.a.
+ 2·0	Heavy sections	17·9	23·8	132·9	4·1
	Light sections	30·0	37·1	128·7	3·7
+ 4·6	Wire rod	14·3	20·8	146·9	5·6
+ 2·7	Total sections	62·2	81·7	131·4	4·0
+ 2·7	Hoop strip and tube strip	10·5	12·2	116·2	2·2
+ 3·4	Plate ≥ 3 mm	21·0	26·9	128·1	3·6
— 25·0 (1)	Hot-rolled sheet	1·1	1·9	172·8	8·1
+ 10·5 (1)	Cold-rolled sheet	36·0 (2)	46·3	128·8	3·7
+ 4·7	Total flats	68·6 (2)	87·3	127·4	3·5
+ 3·7	Total finished products (excluding coils finished products)	130·8 (2)	169·0	129·3	3·7
*	Coils — finished products	9·9	14·1	142·4	5·1
*	Total all finished products	140·7	183·1	130·2	3·8

(1) Community in its original composition only.
(2) Includes revised figure for Federal Republic of Germany.
* Not available.

Sections production potential is expected to grow faster than that for flat products with an annual average rate of increase of 4·0 %. In particular the growth in production potential for wire rod is expected to be 5·6 % p.a. rising by 6·5 million metric tons from 14·3 million metric tons in 1973 to 20·8 million metric tons in 1980. More than 4 million metric tons of this increase is accounted for by projects already decided by the enterprises before the end of 1974. A breakdown of forecast wire rod production potential by country is given below.

Wire rod production potential

(million metric tons)

Country	1973	1978 (1)	1980 (2)
Federal Republic of Germany	5·2	6·1	6·1
Belgium	0·9	1·5	1·8
France	3·1	4·4	4·9
Italy	1·7	2·2	3·3
Luxembourg	0·5	0·5	0·5
Netherlands	0·5	0·5	0·6
United Kingdom	2·3	3·7	3·3
Denmark and Ireland	0·1	0·1	0·3
Community	14·3	19·0	20·8

(1) Arising from projects already in progress or decided. Source: ECSC 1975 Investment Survey.
(2) Arising from projects in progress, decided and planned.

Growth in heavy and light section production potential is also likely to be rapid — 4·2 % p.a. and 3·1 % p.a. respectively, compared with a combined growth rate of actual production of 2·0 % p.a. between 1960 and 1973. The expected increases by country are given in the table below:

Increases in heavy and light sections production potential by country 1973 to 1980

	Heavy sections million metric increase	Light sections million metric increase
Germany	1·3	0·4
France	1·9	1·2
Belgium	—	0·9
Italy	1·0	2·4
Netherlands	—	0·2
Luxembourg	0·9	0·5
United Kingdom	0·6	1·4
Ireland	0·1	0·1
Denmark	—	0·1
Total increases	5·8	7·1

The Community production potential for coils is expected to increase from 54·4 million metric tons in 1973 to 73·9 million metric tons in 1980. A table comparing the figures for coils production potential with those of flat products made from coils is contained in the section on the Demand/Supply balance.

Production potential for all finished flat products including coils — finished products is expected to increase from a level of 78·5 million metric tons in 1973 to 101·4 million metric tons in 1980, representing an average growth rate p.a. of 3·7 %. Excluding coils — finished products, the rate of increase in flat product potential is only 3·5 % p.a., as against a 4·7 % p.a. increase in actual production from 1960 to 1973.

Figures are given below for several categories of product which have already been included under the heading of cold-rolled sheet potential, but whose production potential depends as much on ancillary facilities as on the rolling mills themselves.

Production potential for several flat products

Product	Total Community production potential		Total increase (1973 = 100)	% growth p.a. 1973 to 1980
	1973	1980		
Stainless cold-rolled sheet	0·8	1·3	162·7	7·2 %
Tinplate	5·4	6·2	114·9	1·9 %
Galvanized and electrozinc coxed sheet	5·7	7·1	124·7	3·2 %

The substantial increase in production potential for stainless cold-rolled sheet is due to plans to more than double capacities in France and the United Kingdom.

The expected rate of increase in tinplate production potential is low in tonnage terms. A considerable increase in production potential is necessary however because of the growing quantities of specially thin sheets.

In this chapter figures of production potential are drawn mainly from the investment enquiry carried out during the first half of 1975. During the second half the steel market recession has worsened and has caused such a fall in steel industry revenues that the realization of the production potentials cited above must be questionable. Moreover the investment enquiry of 1975 indicates that many investment projects are so far advanced that 1980 production potential of at least 213 million metric tons of crude steel will be available. This production potential would be available, when no deferments of investment activity, due to the present recession occur, already in 1978.

The danger exists however that, when the current depression continues and own resources remain inadequate, the steel industry must finance investment to such an extent through credit that a too high debt ratio will result. Furthermore the danger exists that the shortage of capital will result in replacement investment destined for modernization and rationalization will not be carried out to a sufficient extent and the competitive capability of the Community works will suffer.

C — *EQUILIBRIUM*

Because of the availability of information, the comparison between the production potential of the steel industry of the Community and the demand upon it is limited to blast furnaces, steel making plant and rolling mills. The lack of homogeneous data does not permit a retrospective analysis for the enlarged Community and all references to the period before 1973 relate only to the Community in its original composition.

As is indicated by the following table, the market requirements of the Community steel industry for pig iron in 1980 are easily covered by the production potential.

Table — Balance of the supply and demand for pig iron

(million metric tons)

Year	Production potential	Production	Rate of utilization (%)
1960	57·2	54·0	94·4
1969	88·4	79·3	89·7
1973 (1) EUR-9	124·8	106·8	85·6
1980 (1)	157·7	118·5	75·1
(2)		129·1	81·9

(1) Average trend.
(2) Upper limit.

The rate of utilization, whether for the average trend or the upper limit, are relatively low. They lie at a level comparable with those achieved in 1971 (76·7 %) and in 1972 (80·0 %), these both being periods when activity in the steel industry experienced a rather marked slowdown.

Of course the rate of utilization may vary among other factors because of a breakdown of the production by process which is not proportional to the breakdown of the production potential available or because of the situation on the scrap market or even the development of the supply of prereduced pellets.

Production potential for crude steel will increase more rapidly than demand in the coming years. The latter could reach a maximum level of 183 million metric tons in 1980 in comparison with the production potential of 228 million metric tons. The obstacles which hinder the full utilization of the declared production potentials have already been underlined. The following table indicates the rates of utilization achieved during previous periods of high activity.

Table — Equilibrium of supply and demand for crude steel

(million metric tons)

Year	Production potential	Production	Rate of utilization (%)
1960	76·2	73·1	95·9
1969	120·9	107·3	88·8
1973 EUR-9	174·5	150·1	86·0
1980 (1)	228·0	170·0	74·3
1980 (2)		183·0	80·3

(1) From 1973 average trend.
(2) Upper limit.

Since 1960 the rate of utilization has shown a relatively significant decrease in successive periods of high activity. The rate for high activity in 1980, if the investments in expansion of production potential are achieved, will be a relatively low one. Such investments carry with them the risk of a prolonged period of under-utilization of steelworks, this being more so since the continuous casting installations will probably work at a higher rate than the traditional installations. Thus it would appear necessary to delay until after the period under consideration certain investments and to accelerate the closure of obsolete steelworks in order to diminish the production potential for crude steel which has already been declared for 1980 by at least 10 million metric tons. The 213 million metric tons announced for 1978 will be adequate to cover the expected maximum demand of 183 million metric tons of crude steel in 1980, this giving a utilization rate of 86 %.

The current recession may cause such a fall in investment in the Community iron and steel industry that the probability of overcapacities is virtually non-existent. A priority should be accorded to investment in modernization in order to strengthen as much as possible the competitive capability of the Community steel industry.

The analysis of production potential and the determination of an equilibrium for rolling mills is more complex than that for steelmaking plant. Certain rolled products can in effect be produced on a specialized mill or on a multipurpose mill. Furthermore, in certain cases, the relatively low rate of utilization can be explained by the circumstances in which firms find it necessary to have the capability to cover very specific requirements whose incidence over time is very variable.

The situation varies widely between long and flat products. Long products have been divided into two categories: sections and wire rod. In 1980 the following table shows that section mills will be used in the upper limit case at a rate some 4·5 % below the level achieved in the year of high economic activity 1973, i.e. 73·9 % against 78·3 %.

The rate of utilization for 1980 is relatively low in comparison with previous years of high activity. However the situation seems more disquieting when one compares the development of heavy and light sections separately. For the latter the estimates approximate to a utilization very close to that achieved in 1973. By contrast the utilization of heavy section mills lies around 66 % at the upper limit and 62 % for the average trend.

In respect of wire rod, the investments planned for this type of mill imply the lowest rate of utilization registered since 1955. Certain firms have, in fact, announced such an increase in their production potential for wire rod that one can expect serious marketing problems for several years after the commissioning of these mills. An improvement of the rates foreseen would result from an acceleration of the withdrawal from service of old installations. This would appear to be more practicable in enterprises that operate new and old installations at the same time.

It should, however, be noted that the production of reinforcing bars has been attributed in this analysis to the light section mills although part of the output will without doubt be produced on wire rod mills.

Equilibrium of supply and demand of rolled products (1) — 1980

(million metric tons)

Products	Production potential 1980	Total demand 1980		Rate of utilization				
				1980		1973	1969 (2)	1960 (2)
		Upper limit	Average trend	Upper limit	Average trend			
Sections	60·9	45·0	41·9	73·9	68·8	78·3	78·6	89·4
Wire rod	20·8	14·0	13·0	67·3	62·5	83·9	78·2	91·5
Hoop and strip of which ex coils	12·2 (3·0)	11·0	10·0	90·2	82·0	82·9	78·8	88·7
Plate ≥ 3 mm of which ex coils	26·9 (6·6)	22·9	21·4	85·1	79·6	74·3	76·6	83·9
H.R. plate ≤ 3 mm of which ex coils	1·9 (1·7)	0·7	0·6					
C.R. sheet ≤ 3 mm	46·3	39·7	36·3	85·7	78·4	78·6	88·4	96·1
Total finished products	169·0	133·3	123·3	78·9	73·0	78·7	80·5	89·6

(1) Excludes coils (finished products), ingots and semis.
(2) Comunity in its original composition.

For flat products the rate of utilization according to the upper limit forecast will reach a level superior to that of 1973. These products, with the exception of sheet which is produced on wide strip mills before cold rolling, can be produced on specialized mills or from coils for certain dimensions and qualities.

The total demand for strip, heavy and medium plate and hot-rolled plate exceeds, on occasions significantly, the production possibilities of the specialized mills; nevertheless, the allocation of the workload of wide strip mills, such as has been programmed by the enterprises, will permit the demand, with the exception perhaps of strip, to be easily covered. The rate of utilization of 90·2 % foreseen for the latter is, taking into account past experience with maximum possibilities of production, difficult to achieve. It will thus be necessary to allocate production possibilities ex coils greater than those declared.

The utilization of the possibilities for hot-rolled plate may be lower than indicated because of the possible substitution between this product and coils (finished product).

The production possibilities for cold-rolled sheet appear satisfactory; no shortfall will arise for this type of mill.

Finally the following table gives a comparison of supply and demand for hot-rolled wide strip. The table only gives broad indications since the available data does not permit the division of production between specialized mills and wide strip mills in an exact manner. It has been assumed in order to establish the figures in this table that specialized mills will be operated at 85 % of capacity, the balance of the requirements being produced ex coils. Such an assumption seems more likely to be achieved in periods of high economic activity rather than normal activity. Furthermore, no account has been taken of the difference in quality of products from specialized mills and those from hot rolled wide strip mills.

Equilibrium of supply and demand of coils — 1980

(million metric tons)

Products	Production ex coils		Conversion coefficient	Requirement for coils		Possibilities of production ex coils declared for this product	Rate of utilization %		
	Upper limit	Average trend		Upper limit	Average trend		Upper limit 1980	Average trend 1980	1973
Coils, finished	9·2	8·5	1·00	9·2	8·5	14·2			
Hoop and strip	3·2	2·2	1·05	3·4	2·3	3·0			
Plate 3 mm	5·6	4·1	1·07	5·9	4·4	6·6			
H.R. Plate 3 mm	0·5	0·4	1·07	0·5	0·4	1·7			
C.R. Sheet 3 mm	39·7	36·3	1·09	43·3	39·6	46·3			
Not specified (1)						2·0			
Total	58·2	51·5	—	62·3	55·2	73·8	84·3	74·7	82·5

(1) Correspond to the possibilities of production of coils of which use is not specified and which can thus be considered as a reserve.

The table shows that the workload of the wide strip mills does not correspond to the expected breakdown of requirements. The supply of coils seems largely adequate to meet total demand; a slight reduction of the former would even seem desirable if, taking account of the significant production possibilities of each mill, it can be achieved. The firms could however, with a view to better utilization of the wide strip mills, avoid where possible increasing the production possibilities of certain specialized mills.

The situation described here for the various rolled-steel products is the same for crude steel in that the current recession is leading to a reduction of investment activity also in this sector.

The investment enquiry which has already been mentioned indicates however that even by 1978 a production potential for wire rod of 19·0 million metric tons is expected, this corresponding to a maximum utilization rate of only 74 % in 1980 as opposed to 84 % in 1973. The investments in this sector are so far advanced that danger exists as before of unused capacity. No such danger exists for sections since the production potential in 1978 is calculated to be 54·5 million metric tons. This production potential would result in the year 1980 with maximum demand in a utilization rate of 82·5 % compared with almost 78 % in 1973. In the case of flat products the expected production potential in 1978 will scarcely be adequate to cover the expected maximum demand in 1980. Attention should be paid here that all the investments planned for 1980 should be realized. The results of the above for investment policy are that action should be taken in the case of wire rod so that as far as possible no expansion for the present of the production potential over the levels expected in 1978 should take place whereas in the case of flat steel the realization of all production potential through to 1980 should be sought.

In average conditions, crude steel market requirements in 1985 could reach 188 million metric tons, and under maximum conditions 202 million metric tons. Thus, based on a rate of utilization of 85 per cent (the rate in 1973), the production potential required in 1985 would be about 232 million metric tons. Between 1980 and 1985, one could expect to see that withdrawal from service of the traditional basic Bessemer and almost all open-hearth processes, combined with a continued expansion of the share of the electric and oxygen processes in total production.

With respect to the development of Community production potential for finished products, flat products potential should grow somewhat faster than long products between 1980 and 1985 following the development of demand.

CHAPTER IV

DEVELOPMENT OF STEEL GRADES AND STEEL PRODUCTS

The preceding chapter concerned the quantitative development of steel consumption. The ever more stringent demands by steel users regarding the properties of steel products now make it necessary to undertake a qualitative analysis as well. The development of qualities is also of significance in view of the competition from the newer steel producing countries, as the production of higher qualities gives the Community the opportunity to offset the advantage enjoyed by countries having their own low-cost raw material and energy sources by the export of more technical know-how.

The development of materials for a wide variety of applications is greatly influenced by users. This is also true for steel. Any analysis of the development of steel grades and products must therefore be extensively guided by the predicted trends in the various areas of steel utilization, from which future requirements regarding steel properties can be deduced and conclusions reached on the need for the further development of steel grades or the creation of new ones and the improvement of steel products

Steel grades and steel products for structural steelwork

The structural steelwork sector's requirements for new materials in the near future should be met by the structural steels available at present, particularly since the development of steels with a high yield point (up to 700 N/mm²). This applies both to steel products and steel grades. No fundamentally new developments in this sector are to be expected in the near future. Over the next few years the use of the new steels with a high yield point will become more widespread if progress is made in the areas outlined below.

Progress is needed and should be achieved in the use of high-tensile steels for structures subject to vibration stress. This calls not so much for the further development of the steels as for improvements in fabricating techniques, in particular welding and the possibility of after-treatment for the heat-affected zone. Design methods should be improved by determination of load aggregates. Development work must be carried out to accomplish these tasks.

For all the structural steel mentioned, further development in the way of the improvement of certain fabrication and service properties is desirable. As already mentioned, an improvement in the weldability of the steels is particularly to be recommended as every simplification reduces fabricating costs and improves economic efficiency. It is also important for particular applications to improve the deformation capacity of heavy plate in the thickness direction so as to obviate the risk of lamellar tearing under stress perpendicular to the product surface.

Structural steels with a higher modulus of elasticity would be of great technical significance as for many types of stressing a high yield point is not sufficient; it is of no advantage if the modulus of elasticity is not also increased. As yet there has been no breakthrough towards raising the modulus of elasticity. Basic research is necessary for the development of low-priced steels with a high failure temperature when exposed to fire; this would be of enormous significance. However, other possibilities such as improved design also exist.

Progress in the improvement of resistance to stress corrosion calls for further basic knowledge.

Reinforcing steels for reinforced concrete structures

The important point in connection with concrete reinforcing steels is not so much to develop new steel grades as to improve the utilization of the steel products. Advances in this direction can be based on the fabricating of reinforcing steels from the coil, the development of standardized reinforcing members and economic connection methods and the use of efficient reinforcing techniques.

In the case of concrete reinforcing rounds, the grades and dimensions of which need streamlining, progress in the production of prefabricated reinforcing components direct from the coil requires examination and adjustment of the mechanical properties and sections of the wire rod concerned to make them more suitable for this method of fabrication. Research is necessary here.

As far as mechanical properties are concerned, the development of prestressing steels can also be regarded as completed. Streamlining of the grades, dimensions and shapes is desirable here too. The questions of protection against corrosion and stress corrosion and of stress corrosion behaviour arise in connection with prestressing steels; research and further development in this direction appear necessary.

Steels for chemical apparatus and pressure vessels

For apparatus and pressure vessels for chemical plant and refrigeration engineering future development will (with a few exceptions) be marked not so much by the application of new methods as by the tendency to increase efficiency still further by the use of larger units. Steel development in this sector will therefore centre on the further development of the steels already available, with particular emphasis on the improvement of material with a view to use in larger units and suitability for fabrication, rather than on the development of new steel grades.

The following problem may be regarded as urgent.

Among steels for service temperatures below — 20 °C, Ni-Mo steel containing 5·5 % Ni must be developed and its service behaviour at temperatures as low as —164 °C investigated with a view to its use for the liquefaction of natural gas. For both this steel and steel with 9 % Ni welding methods and filler metals must be further developed as regards yield point and toughness. Stable austenitic steels for refrigeration engineering below —196 °C need to be improved as regards weldability (avoidance of hot cracking) and stability of structure even after cold forming.

In the category of steels for the temperature range —20 to +150 °C, increasing use is likely to be made of special steels (in particular quenched and tempered steels) for large storage containers. This calls for research to improve the technologies for the production of cold-pressed parts (cold-dished segments for spheres). Of special importance in this temperature range is the need for stress relieving after welding depending on the steel grade and product thickness, a subject that can only be clarified by experiments on component-simulating test pieces. Improved cold forming capabilities would also extend the use of controlled rolled plate in these sectors.

Further development of high-tensile steels as regards weldability (toughness in the heat-affected zone, liability to cold cracking, resistance to cracking during stress relieving) is still regarded as necessary and the same need emerges in other sectors.

There is much to be done as regards steels for temperatures exceeding 50 °C. Mention may be made of the further development of high-tensile steels with a minimum yield point exceeding 530 N/mm^2 for clad plates in multi-layer vessels, improvement of resistance to ageing embrittlement in Ni-Cr-Mo heat-treatable steels for service between 300 and 400 °C, extension of the fields of application of ferritic-austenitic steels to more acid solutions, improvement in the weldability of stable austenitic materials by reducing susceptibility to hot cracking, verification of the permissible carbon content in corrosion-resistant nickel alloys as regards resistance to inter-granular corrosion of the welded joints and improvement of resistance to carburization and the strength of the oxide layers in the case of high-alloy heat-resistant materials.

Steels for steam-generating stations

The future lines of development for materials for steam-generating stations are largely determined by the fact that cost increases make it necessary to build larger and specifically cheaper units and conventional power stations will increasingly be used only for medium and peak load supplies alongside nuclear power stations generating the base load. This changes the demands on heat-resistant steels. As a result, the development of materials will be determined not so much by the need to create new types of steels as the need to obtain further knowledge of the used properties of the known steels (in the fabricated state as well) so that they can be properly adapted to all the types of stressing likely to arise; this will at the same time increase the economic efficiency and availability of the power station.

Of the tasks to be undertaken in the near future, special mention may be made of the need to obtain further knowledge of the creep properties of steels under non-continuous loading and subject simultaneously to several types of stress. The alternating stresses occurring in service call for the determination of the number of stress cycles for crack initiation under suitable experimental conditions in order to assess the stress resistance of the materials. Also a better verification of the scatter bands, in particular for the creep limits over very long periods, is required.

Research into the creep behaviour of welded joints having regard to the influence of the welding method and subsequent heat treatment is also of importance. Priority should be given to the development of methods for the adequate testing of welded joints. The effects of hot and cold fabrication on creep behaviour should also be investigated, as should the possible effects of new production and fabricating methods.

In view of the increasing use of thick-walled components as units become larger, it is important to verify creep behaviour and other mechanical properties (particularly fracture toughness) in large cross-sections. In this connection, and also because of the further rise in steam pressures and/or temperatures, consideration should be given to the use of other steels, e.g. austenitic steels, with higher mechanical properties, as they enable the product thickness to be reduced.

Steels for nuclear-power stations

A — *STEELS FOR REACTOR-PRESSURE VESSELS*

Over the next decade the generation of electricity from nuclear energy will be carried out mainly in light water reactors. Sodium-cooled fast breeder and gas-cooled high-temperature (HTR) reactors will gain ground; prototypes of the former type have recently been put into service.

Light water reactors (LWR) have now reached a certain unit size all over the world. Some consideration is being given to enlarging the units, but outputs of over 1 300 MWe are hardly to be expected in the near future. The major points in connection with the reactor pressure vessels for these LWR are the standardization of construction and improvement of economic efficiency in their production, amongst other things by increasing fabricating reliability for the materials used (forgings, plates). This involves the use of relatively low-alloy steels with no welding complications, in the fabricating of which there is wide experience. Consequently in the next few years higher-alloy steels are unlikely to replace the steels currently used for reactor pressure vessels. There are signs of a move from Ni-Mo-Cr steel containing about 0·9 % Ni and 0·7 % Mo to Mn-Mo-Ni steel with about 1·2 % Mn, 0·5 % Mo and 0·6 % Ni; this development is of interest to the pressure vessel industry in general. In view of the increasing trend towards inclusion of strength and toughness figures for the core zones in design calculations it will be necessary to obtain measures values for the properties over the production cross-section in very heavy forgings of the latter steel and possibly to determine minimum values; this will require extensive and costly investigation. It is also possible that the results will show the need to develop the known steels further in order to meet the requirement for the maintenance of the guaranteed values even in the core of components of maximum wall thickness.

Over the next 10 years, unstabilized austenitic Cr-Mo-Ni steels with about 18 % Cr and 11 % Ni and with about 17 % Cr, 13 % Ni and 2·5 % Mo or suitable variants will remain the leading materials for the major components of the primary system of sodium-cooled fast breeders, followed by stabilized austenitic Cr-Ni steels with about 18 % Cr and 10 % Ni and additions of titanium or niobium. Here it is necessary to obtain additional data in the following fields: high temperature behaviour for the purpose of non-elastic material assessment, behaviour under specific radiation conditions, safety aspects with the aid of fracture mechanics, material behaviour under fault conditions, influence of specific coolant parameters on material behaviour.

Information will also be required on the corrosion and elevated temperature properties of steels exposed to helium gas for HTR applications.

No steel problems specific to reactor applications have emerged in the field of high-temperature reactors.

Steels for hydro-electric power stations

Despite the relatively small share of hydro-electric energy in total primary energy, there will in future be a considerable increase in the electricity produced in hydro-electric power stations. Consequently the steels used in their construction are not without significance.

Stainless and low-alloy grades of steel castings, whose development may be regarded as terminated, are used in the hydraulic plant of these power stations. However, with the trend to larger units they will have to be used in greater thickness. It is therefore necessary to obtain reliable data on their properties. There is also a lack of reliable data on static and dynamic behaviour under the simultaneous effect of corrosion; the provision of such data will improve design calculations for the use of these steels. The chemical composition of cavitation-resistant chromium-nickel grades of cast steel with 13 % Cr and 4 or 6 % Ni having good welding properties can be modified and optimized for specific stress conditions. Casting technology for the production of very heavy turbines will have to be improved. Cast steel other than stainless steel must be further developed so as to obtain higher yield points with good weldability even in very thick-walled parts. This will probably be possible with the use of low-alloy or micro-alloy steels.

Sheet from high-strength hot strip will be increasingly used in the electrical installations of power stations. As it is to be expected that the requirement regarding flatness, thickness tolerances, surface finish, magnetic properties and above all yield point will become much more stringent in the course of further development, research into alloying and rolling methods should be carried out to ensure that certain detailed aspects of these requirements can be met. The starting point for the research will be micro-alloy steels subjected to thermomechanical treatment which are rolled in suitably equipped mills and exhibit a specific scale formation as after further development these steels may be expected to meet the more stringent requirements. For penstocks in hydro-electric stations the trend towards higher yield points and greater wall thickness will be continued. Development work is needed on parts of very large dimensions.

Steels for turbines and generators

In the case of heavy forgings for electric generating plant steels grades need to be developed because of the ever larger dimensions and the stricter quality requirements, especially for less segregation, lower contents of non-metallic inclusions, adequate quenching and tempering right through the thickest dimensions, good resistance to brittle fracture and where necessary long-term heat resistance.

For the medium- and high-pressure turbine shafts in conventional power stations, which have to operate at steam temperatures of about 550 °C, the steel grades in use at present will most probably suffice in the future. For low-pressure turbine shafts an attempt will be made — regardless of design — to obtain 0·2 % proof limits of up to 1 000 N/mm².

Steam turbine shafts in nuclear power stations with light water reactors operate at about 300 °C. For the development of high-pressure shafts, the same applies as to the low-pressure shafts in conventional power stations. Because of the volume of steam, large disc diameters of up to 3 000 mm are required in the low-pressure range. Because of their large dimensions, the shafts must be of either shrunk-on or welded construction. This gives rise to no special difficulties for the shafts. However, for the discs it is desirable both to increase substantially hub thickness in shrunk-on construction up to about 1 100 mm, disc thickness for welded construction up to about 950 mm and to raise the 0·2 % proof limit; further development of these steels is therefore necessary.

For steam turbines in nuclear power stations with high-temperature reactors, which in the secondary circuit are similar to those in conventional steam generating plant, energy units of 2 500 MWe are contemplated and consequently it will be necessary to produce ingots of 300 metric tons, giving rise to metallurgical and forming problems. In view of the prevailing conditions of creep stress and the requirements regarding security against brittle fracture, new steel grades will have to be developed for diameters of up to 2 000 mm.

In two-pole generators operating at 3 000 or 3 600 r.p.m. the barrel diameter of the generator shaft is limited to about 1 250 mm with the material currently available for the non-magnetic rotor and bells. Outputs of up to 2 000 MVA could be obtained with barrel diameters of 1 300 mm, but for this it is necessary to develop suitable materials for the rotor and bells (see below). For the shafts the steels now in use will suffice even with larger diameters.

Four-pole generators operating at 1 500 or 1 800 r.p.m. need barrel diameters of up to 1 800 mm with a shaft weight of up to 200 metric tons. They can be of shrunk-on construction or made of one part from ingots of weights up to more than 300 metric tons (the maximum at present is about 500 metric tons for a shaft of about 280 metric tons). Here the steel grades give rise to no difficulties but the production of ingots and forgings of adequate metallurgical quality does.

Generators with supraconductivity of the rotor winding obtained by cooling with liquid helium are a special case. The rotor body must be a non-magnetizable steel that must also be precipitation hardened because of the high strength requirements. Here there is a need for development or further development of the steels.

To produce ingots for heavy forgings all the possibilities of modern metallurgy, technology and testing techniques (including ultrasonic testing) must be used and further developed. It is necessary to ascertain the best ways of producing large ingots, whether in one piece or by welding, whether by casting one large ingot or by building up an ingot step by step after various processes.

In order to manufacture the generator end rings with 0·2 % proof limits of considerably above 1 300 N/mm^2 needed to obtain high electrical capacities, the austenitic Mn-Cr-(V) steels with about 18 % Mn currently used must be modified by special alloy additions or new materials of a different composition or type must be developed. The avoidance of stress-induced corrosion is a special problem here.

Steels for motor vehicles

The further development of steels for the motor industry must be viewed from the joint aspects of safety and non-pollution. For a mass-produced product available to a large section of the population, economy is also an important aspect and this calls for a high uniformity of steel fabricating properties amongst other things.

The available sheet with high formability and strength requirements for use in bodywork and for safety and running parts must be further developed to obtain higher yield points; from the safety angle, an improvement in spot weldability is of particular importance as high-tensile-strength sheet can only be used to full advantage in vehicles if it can be reliably spot welded. Furthermore, for critical components more attention needs to be devoted to the definition of optimum defect levels and the ensuing inspection related to these defect levels. For sheet there is a need for inspection criteria that will provide a better correlation with its behaviour in industrial pressing. It is also necessary to develop testing methods for the reliable definition of the surface finish of sheet and strip.

Plates used in the construction of goods vehicles must be further developed to increase the existing minimum yield point of about 500 N/mm^2. Fatigue strength, resistance to brittle fracture and suitability for cold bending must also be improved.

Surface-treated sheet is used mainly for decorative and functional purposes. The demand for greater corrosion resistance, in general, increases the significance of surface-treated sheet (also of considerable interest outside the motor industry) and areas for useful investigation include more definitive comparison between the performance of various metallic coated and organic coated steels in various applications. In addition, the requirement for good weldability and ease of forming show the direction in which these materials must be developed.

Rolled and forged products of case-hardening and heat-treatable steels are used mainly for engine and gears, axles, steering gear and springs in the motor industry. The further development of these steels is determined largely by the demand for the improvement and greater uniformity of fabricating properties. For example, it is necessary to establish clear correlations between chemical composition and degree of purity on the one side and cold formability on the other. The same applies to machinability. More information must be obtained on the influence of the degree of purity on fatigue strength. The demand for greater uniformity of properties means that testing methods must be improved or new methods developed for the unambiguous definition of the significant properties. The large-scale mass production of vehicles makes economy of great importance, especially in heat treatment methods, for example. The work on the simplification of this production stage, which in some cases is only possible by fundamentally modifying the chemical composition of the steels, must be continued.

Steels for the railway industry

The future of steels for the railway industry will be crucially affected by the development of high-speed transport and bulk goods traffic in special networks. Because of the higher speeds and higher permissible axle loads, the rails must have improved resistance to breaking and higher strength. In addition good weldability and reduced sound radiation are becoming of increasing importance. The necessary development work on self-hardening rails has been started. However, rising costs for alloying elements may encourage a move towards heat-treated rails of non-alloy steels, for which development work is necessary, especially as regards welding, rail corrugation and noise reduction. Development work on sections should be terminated with rail sections of about 70 kg per linear meter. The number of sections should be reduced.

Factors influencing the development of wheel materials are the same as for rail. The solid wheel with low internal stress and improved resistance to cracking due to thermal shock will gain ground.

Axles will be of the hollow type, made of higher strength tough steels.

Work on the development of suitable steels for small wheels and axles with low internal stress used in lightweight structures has already started but must be extended.

Shipbuilding steels

To meet market requirements in recent years the conventional ships built by welding have been supplemented by new types of vessel such as container ships, oil tankers and liquified gas tankers. At the same time the size of the vessels has increased, partly for economic reasons. This has made higher demands on the steel. Particular attention has been paid to corrosion protection.

In view of these factors, the following work is needed in connection with the use of heavy and medium plate, universals, sections and flanged parts:

— further development of the steels already in use with particular regard to the special demands depending on the type of ships,

— further development of the steel grades already in use with a view to the use of high-capacity welding methods with a high heat input and welding without preheating as far as possible (there is also a need to improve and automate the high-capacity welding methods, especially for the welding of thick plates (up to 40 mm)). Means of avoiding post-weld treatments would represent a significant advance,

— development of weld filler materials with properties matching the parent metal, suitable for use with high-capacity welding methods (especially for single side welding),

— development of improved protective measures to prevent or reduce corrosion,

— development of corrosion-resistant steels for shipbuilding with tensile strengths of 400—490 and 490—590 N/mm^2,

— development of cast steel grades with high toughness for towing equipment.

Steels for mechanical engineering

It is difficult to cover the whole mechanical engineering sector at once as the property requirements can vary greatly from one application to another and extend over almost the full range of possible steel properties. However, a survey of individual fields shows the following general trends.

Development to date has led to better steel utilization and consequently a substantial increase in efficiency and there is today a trend towards reducing the cost of materials, simplifying storage and optimizing and standardizing properties (e.g. by heat treatment in automated continuous installations). The measures being taken result in a narrower scatter for material properties (e.g. hardenability, temper, grain size, machinability, freedom from decarburization, etc.) and product characteristics (e.g., dimensional accuracy, lack of roundness, straightness, low distortion owing to freedom from stress, etc.). This is true notably of machine components but also of tools, for which hardness, compressive yield strength, cutting edge life and hot yield point are also important.

Future development will see a continuation of the efforts being made at present. For the standardized steels available at present the guaranteed quality and uniformity of the properties must be increased by improved and more economic methods in automated processes. Local improvements in properties by inductive surface hardening, nitriding, or treatment with boron of suitable simpler materials must be further developed and made more economic. The measurement of component strengths (as opposed to the traditional determination of tensile strength on test pieces), dynamic values and fracture mechanics values will enable improvements to be made in the life, load capacity and safety of machine components. Surface treatment methods are of particular importance.

Steels for marine technology

In addition to the known technologies of shipbuilding, port construction, conveying and apparatus and pipeline construction used in marine technology, new techniques have recently been developed, especially in the offshore sector.

Offshore applications call for steels meeting specific requirements arising from the structures and service stresses involved in the recovery of petroleum and natural gas. These steels are for floating, semi-submerged and fixed tubular platforms and for workboats. They must have high static and/or dynamic mechanical properties, good resistance to brittle fracture and good weldability and the property values must be isotropic. Weldability is of particular importance. The high-tensile steels that are used for a variety of reasons require special care in welding. Work to improve high-tensile steels (with yield stresses up to 700 N/mm^2) or develop new ones that can be fabricated more easily is essential. For offshore structures, isotropy of properties is also very important; for example, good toughness perpendicular to the product surface is necessary as there is a danger of failure arising from the complex nodus joints.

Steels for pipelines

Although a number of different products are transported in bulk by pipelines, oil and natural gas pipes are of particular importance because of their number and the technical demands on them. Pipelines may be designed and operate as land lines in normal climatic regions or in arctic regions and as undersea lines; both welded and seamless tubes and fittings are used in them. The demand for a higher transport capacity in most pipelines is met mainly by submerged arc welded tubes with a longitudinal or spiral seam. Their dimensions at present range up to about 1 400 mm outside diameter and 25 mm wall thickness. The yield point, the most important design parameter, has now increased to about 500 N/mm^2 with the advances in the thermomechanical treatment of plate and strip.

The future development of this field of application will be governed by the opening up, in order to meet the growing demand, of primary energy deposits in regions having extreme climatic conditions and in the sea bed where pipelines will have to be laid at great depths. New applications will include liquefied gas pipelines and electricity lines in hollow conductor tubes. During the period under review, an increase in tube dimensions to 1 550 mm diameter and about 40 mm wall thickness and in the yield point to about 700 N/mm^2 is to be expected. In addition to the further development of thermomechanical treatment methods, progress will have to be made in the quenching and tempering of large pipe dimensions and the fabrication of tubes from quenched and tempered plate. The most important aim is high reliability of the pipelines even under extreme conditions and with improved mechanical properties. This will primarily affect the toughness criteria from the aspect of fracture mechanics.

As far as new products are concerned, the question of whether the safety considerations valid for normalized steels subjected to thermomechanical treatment can be applied to quenched and tempered steels is of primary importance.

CHAPTER V

PRODUCTION TECHNIQUES

The general objectives for the steel industry will be influenced by some general factors and trends, which characterize the technical development and can be summarized as follows.

Iron and steel production

It can be assumed that in the coming years the main technological stress will not be laid on further enlargement of capacities per working unit (blast furnace, oxygen converter, mill-train), but on improving efficiency (materials, energy and labour). This will involve an increase in flexibility, mainly in respect of different raw materials, different forms of energy and on better meeting the demands of the environment in terms of pollution control, higher durability of steel products and recycling of waste material and scrap.

To meet these long-term requirements, developments of new, and the improvement of existing, technologies in the field of iron and steelmaking may be required.

Coke

In the field of production of coke, research and development need to be intensified. The traditional, discontinuous process needs to be improved in regard to productivity and pollution. On the other hand, the development of new, continuous processes for the production of form-coke from coals which are less or not at all suited for the conventional coking process needs to be intensively continued.

Blast furnace

No further enlargement of blast furnace dimensions above the present maximum size of about 4 000 m^3 is expected.

Attention will have to focus on increasing flexibility and efficiency in regard to input materials and energy, and on decreasing pollution. Research, development and investment will be necessary in the field of pretreatment of burden materials, in order to achieve the production and use of more sinter or pellets of consistent chemical and physical properties. In this context more ore homogenization installations will be required.

Further increase of blast furnace efficiency will be pursued by improved measuring devices for controlling the process by the application of blast temperatures up to 1 300 °C, by partial replacement of coke by injection of coal, oil or gas (hot reformed gas) and by improved refractories and cooling systems and improved performance of all the heavy and complex mechanical devices around the furnaces which lead to frequent production interruptions.

Much attention will have to be given, especially in the area of sintering, pelletizing, iron making and coking, and to ways and means of pollution control; apart from installations needed for fighting pollution, it is necessary to develop processes which cause less pollution.

Direct reduction

This is still a rather young technology and it is expanding rapidly. It will not replace the blast furnace process but will be a useful complement, depending on prevailing local conditions and input materials. Gaseous or solid reducing materials are needed and those processes using solids might be developed for the production of sponge iron from ores that are less suited to treatment in shaft furnaces, or for making sponge iron from iron-containing dusts or slurries.

Steel making

The capacity of oxygen converters and electric furnaces has grown rapidly over the last 10 years. Improvements in data transmission in methods of chemical analysis and in the transport systems have made it possible to use the high capacities so that for the big units tap-to-tap times have remained under 40 minutes.

The OBM (Q-Bop)-process merits much attention. The decline in the use of the basic Bessemer process has since 1970 been compensated by the introduction of the OBM-process. Not only has this useful replacement of the basic Bessemer converters in Europe taken place, but it is also used for low-phosphorus hot metal in large converters, and looking at the advantages in investment and in yield further growth of the process is to be expected.

Further development of systems for on-line process-measurements is required for the higher demands of the fast processes; process-control is and will remain a very important factor.

Electric arc steelmaking should further develop in the direction of a lower and more balanced energy consumption. Continuous charging of scrap and sponge iron and preheating or even premelting of these materials could be a step in the right direction.

In order to increase efficiency, quality and yield (especially in the use of ferro-alloys), there has been a growing tendency, in making special steels, to split up the steelmaking process into a sequence of steps, each step taking place in special apparatus, using vacuum, inert gas-oxygen mixtures, electromagnetic stirring, electro slag-remelting, vacuum-electric arc furnaces, electrobeam furnaces, and in future possibly plasma-arc furnaces. This development should continue, necessitating research and also the development of still better refractory materials.

Electro slag-remelting will gain importance for the production of clean ingots for heavy forgings. In this connection it must be stressed that the capacity in the Community for the production of very heavy (400 metric tons) ingots of clean steel for forging purposes will have to be developed, in view of the increasing size of nuclear power plants (pressure vessels and turbine generator shafts).

Step-by-step steelmaking is also being increasingly applied for structural steels; for example desulphurizing is taken out of the basic oxygen converter and done before blowing or transfer to the steel ladle.

Generally, more and more 'ladle metallurgy' is applied. In this connection vacuum-treatment and pretreatment or preselection of scrap should also be mentioned.

The new methods and the high rate of availability demanded necessitate a high level of quality of refractories. In the case of a restricted and a clearly defined metallurgical practice it will be possible to define better the quality requirements for the refractory. In this way the problem can be solved by steel producers and refractory makers in joint research and development.

There is no doubt that continuous casting should and will be increasingly applied, thanks to the progress that has been made up to now (especially in pouring speed) and to the advantages it has shown (larger coil weights possible, shorter inclusions, and especially high yield in the case of killed steels). However, there are still some fundamental problems to be resolved in order to obtain a clean surface with extra deep drawing steels and a crack free surface with high strength steels.

Continuous steelmaking is still in the development stage. It will be difficult to match basic oxygen steelmaking for production in regard to efficiency and production capacity. There is, however, a possible case for continuous steelmaking for special economic circumstances (such as modest size production units).

Further intensive research on solidification and alloying of steel will be necessary, partly to control undesirable segregation, but also to make possible precipitation of new phases, fine particles, interstitial elements, etc., during teeming, solidification, or during further transformation and heat-treatment, in order to achieve certain physical-metallurgical structures in the finished product, which are necessary to obtain improved and more stable mechanical properties. An increased resistance against grain growth will have to be built in, especially for thick plates and sections, which have to undergo high temperature heat-treatments, such as normalizing, hotforming and especially high heat-input automatic welding (which is increasingly applied) in order to maintain strength and, e.g. resistance against brittle fracture. Also, the desired reaction of the steel to the newly developed thermomechanical treatments, applied during rolling and afterwards, have to be 'built-in' at the liquid stage. Therefore, a closer cooperation between process- and physical metallurgists will have to be pursued.

Transformation

The expected growth of the use of steel, especially for capital goods, will necessitate the building of new rolling mills or the adaptation of existing ones, to make homogeneous products of generally larger dimensions, narrower dimensional tolerances and better straightness and flatness.

The further development of better weldable, higher strength steels, based on recent experience and results of research in physical metallurgy will necessitate, especially in these new installations, the applications of newly developed thermomechanical treatments (high reduction at rather low temperatures, controlled homogeneous cooling), normalizing quench and tempering facilities. Many European mills are or will become out-of-date in respect of the above points and in comparison with the newest mills in Japan. Therefore, a 'concerted' action might be desirable to improve the position of the Community. Furthermore, it might be desirable to perform heat-treatments such as normalizing and heating before quenching in an inert gas atmosphere or to use inductive heating in order to avoid scale, and thereby improve surface quality and quenchability.

For cold rolled sheet used for motor cars and electrical household appliances, batch annealing will probably have to be partially replaced by continuous annealing in order to improve drawing properties, surface (stickers) and homogeneity of properties. Moreover, it will be the most suitable method to improve strength, this latter being necessitated by the safety regulations for automobiles and by the demand for weight saving.

Continuously hot-rolled coils are to some extent used instead of cold-rolled material. This necessitates a capacity to roll thinner gauges of sufficient flatness and surface quality (pickling and temper rolling). On the other hand the hot wide strip mill is more and more used to make structural steel of increasing thickness. This will demand larger width, more powerful coiling mechanisms, and probably shearing lines and heat-treatment furnaces. One of the disadvantages of coiling (inhomogeneous cooling) will have to be overcome anyway, especially for special low-pearlite pipe-line steels.

Medium width hot-strip mills are increasingly used to produce feed-stock for steel tubes and other profiles. This demands closer dimensional tolerances and metallurgical suitability for continuous welding.

In the field of structural sections more efficient cross sections and the corresponding rolling techniques will have to be developed. Universal rolling of thin-web H-type columns and beams and the rolling of continuously cast dog-bone sections must be introduced in practice. Continuous forming and welding of sections, where rolling is difficult or impossible, will have to be studied as an extension of processes such as auto-fab, already used for construction of very large beams. For large sections, normally delivered in the as-rolled condition up to now, more capacity for normalizing will have to be installed in some countries in order to be able to make the same qualities as those defined for plates. In structures composed of plates and sections both elements should have the same properties, such as weldability and resistance to brittle fracture.

Another field in which improvements will have to be pursued is that of surface and internal defects. This will necessitate development of several inspection facilities, if possible in the earliest stages of the production process, such as hot surface inspection, hot ultrasonics and controlled scarfing.

Furthermore, shot-blasting and pre-painting facilities will need expansion in view of increasing demand. Also in respect of durability it will certainly be necessary to develop more types and qualities of metallic or organic coated products. This applies to all products, the accent, however, being on the lighter gauges for consumer goods. This development leads to the need for further investment in coating facilities. This in particular refers to coating of plates and sections, hot-strip and cold-rolled material in order either to improve drawability, on the resistance to sratching or corrosion during transport. Sometimes the coating is final (zinc, tin), in other cases it has to be removed by the user or sometimes it will serve as a pretreatment for a final treatment being carried out by the user. An example of this is pre-nickel-dipped sheet steel for vitreous enamelling.

Other important points are better utilization and recovery of energy, and increased plant availability. In this connection the following items deserve serious attention:

- rolling continuously cast slabs, so as to make use of their heat content (needs sophisticated production planning and order control),
- improved reheating furnace design, in combination with improved refractories in regard to thermal and mechanical properties,
- improvements in furnace design in order to diminish the necessary relining time,
- better heat recovery or utilization,
- early warning devices, and in general, better control systems on the condition of main bearings and rolls,
- sophisticated, but efficient, computer control of operations: rolling, reheating, straightening, sizing, testing, sorting, despatch.

The necessary developments and improvements mainly affect new installations. In those cases there will also be a need to involve human factors, ergonomics and personnel functions at an early stage in order to achieve a more effective total organization of technical and other factors.

CHAPTER VI

THE WORK FORCE IN THE COMMUNITY STEEL INDUSTRY

A — *HISTORICAL ANALYSIS*

The memorandum on the General Objectives published in 1971 contains a forecast for the work force for the whole Community. In different countries and regions the manning situation varies very greatly from the Community average. On this occasion an effort has been made to pinpoint these variations by country and for a number of regions. Works employing less than 200 workers have been ignored.

The following two tables, covering men on the payroll at 31 December (1), show trends in some of the figures from 1965 to 1973. Actual working hours per metric ton of steel by workers and staff are assessed by assuming that actual working hours of the staff are the same as workers since the statistics only provide a figure for the latter. By considering workers and staff together, rather than workers alone, various statistical difficulties resulting from the increase in the practice of paying workers monthly are avoided.

(1) Apprentices not included.

The number *h* of hours worked per metric ton of steel produced it the inverse of the tonnage of steel produced per hour of work, the latter being more frequently used to measure productivity. The relative variations in the two values are the same and of opposite sign: an increase of 1 % in productivity corresponds to a decrease of 1 % in hours.

By using *h* at the pig iron, steel and rolled-product stages, it is possible to cumulate the hours worked in the departments through which the product passes, allowing for the successive specific inputs. This analysis was carried out in the different regions.

This approach also makes it possible to introduce the hours worked per year and per worker on the payroll into the manpower trends. However it is not possible to compare productivity between regions and countries on the basis of figures quoted in this chapter because of the significant differences in structure of production between regions and countries.

Trends in production, manning and productivity in Community countries (1)

	1965	1968	1970	1972	1973
GERMANY					
Total work force	242 669	222 519	227 657	214 480	219 870
of which workers	200 017	178 801	180 628	165 502	171 688
Actual working hours per annum per worker on the payroll	1 961	1 881	1 878	1 790	1 788
Steel output (million metric tons)	36·8	41·2	45·0	43·7	49·5
Mean % increase per annum		3·8	4·5	— 1·5	13·3
Total actual working hours per metric ton steel	12·9	10·2	9·5	8·8	7·9
Mean % improvement per annum		8·1	3·6	3·9	11·4

(1) No data was available for Denmark and Ireland.

	1965	1968	1970	1972	1973
FRANCE					
Total work force	154 933	136 629	146 137	143 983	151 514
of which workers	124 433	107 115	109 891	106 381	107 872
Actual working hours per annum per worker on the payroll	2 187	2 068	2 010	1 894	1 842
Steel output (million metric tons)	19·3	20·1	23·4	23·7	24·9
Mean % increase per annum	1·3	7·9	0·6	5·0	
Total actual working hours per metric ton steel	17·5	14·1	12·5	11·3	11·2
Mean % improvement per annum	7·5	6·2	5·2	0·9	
ITALY					
Total work force	69 193	67 311	76 544	85 579	89 579
of which workers	58 167	55 992	63 304	69 682	72 795
Actual working hours per annum per worker on the payroll	2 012	1 988	1 781	1 687	1 644
Steel output (million metric tons)	12·6	16·9	17·0	19·7	20·8
Mean % increase per annum	10·1	0·3	7·6	5·6	
Total actual working hours per metric ton steel	11·0	7·9	8·0	7·4	7·1
Mean % improvement per annum	11·6	— 0·6	4·0	4·2	
BLEU					
Total work force	81 899	79 429	82 575	83 068	85 337
of which workers	70 040	67 395	69 871	70 037	72 248
Actual working hours per annum per worker on the payroll	2 094	1 983	1 954	1 865	1 791
Steel output (million metric tons)	13·7	16·3	18·0	19·9	21·4
Mean % increase per annum	6·0	5·1	5·2	7·5	
Total actual working hours per metric ton steel	12·5	9·6	9·0	7·8	7·0
Mean % improvement per annum	9·2	3·3	7·4	11·5	

	1965	1968	1970	1972	1973
NETHERLANDS					
Total work force	18 465	19 204	21 118	22 404	22 954
of which workers	12 050	12 355	13 487	14 570	14 911
Actual working hours per annum per worker on the payroll	1 848	1 804	1 804	1 661	1 617
Steel output (million metric tons)	3·1	3·7	5·0	5·6	5·6
Mean % increase per annum	6·1	16·5	5·9	±0	
Total actual working hours per metric ton steel	10·9	9·4	7·6	6·7	6·6
Mean % improvement per annum	5·1	11·2	6·5	1·5	
COMMUNITY AS ORIGINALLY CONSTITUTED					
Total work force	567 139	525 092	555 508	547 691	569 254
of which workers	464 707	421 658	437 181	426 172	439 511
Actual working hours per annum per worker on the payroll	2 048	1 989	1 918	1 805	1 774
Steel output (million metric tons)	86·0	98·6	109·3	113·1	122·9
Mean % increase per annum	4·7	5·3	1·7	8·7	
Total actual working hours per metric ton steel	13·5	10·4	9·8	8·7	8·3
Mean % improvement per annum	9·1	3·0	6·1	4·8	
UNITED KINGDOM					
Total work force					200 300
of which BSC					171 100

Trends in manpower (1) and steel production in various Community regions

Regions	Total work force					Steel production (million metric tons)				
	1965	1968	1970	1972	1973	1965	1968	1970	1972	1973
North Rhine-Westphalia West	93 186	84 921	84 117	79 620	81 742	15·8	18·3	19·1	19·1	21·7
North Rhine-Westphalia East	74 741	64 451	64 405	57 104	59 244	10·3	10·4	11·1	9·6	10·3
Saar	31 600	28 921	29 811	28 533	29 349	4·1	4·4	5·2	4·5	5·6
Eastern France	89 397	80 526	86 358	79 833	79 756	12·2	12·8	13·9	13·8	14·0
Northern France	29 383	25 637	27 513	31 650	35 411	4·8	5·0	6·6	7·0	7·9
Northern Italy	34 573	33 662	36 056	36 433	37 652	5·1	6·1	6·4	6·5	6·4
Eastern Belgium	26 006	21 665	21 973	21 909	22 436	3·5	4·0	3·8	4·5	4·2
Southern Belgium	30 159	29 534	30 702	30 746	31 519	5·0	5·8	6·4	7·0	8·2
Northern continental coastal steelworks	34 845	40 396	46 161	49 891	55 641	6·6	9·1	12·7	14·6	15·8
Southern coastal steelworks	26 722	26 638	32 715	40 389	45 976	6·3	8·7	8·3	10·0	10·7
England					111 100 (90 300) (2)				13·7	15·0
Scotland					20 700 (19 800) (2)				3·0	3·3
Wales					68 500 (61 000) (2)				8·6	8·5

(1) Workers and staff, excluding apprentices.
(2) BSC in brackets.

In the period 1965 to 1968 production in the Community as originally constituted after an initial period of recession, picked up vigorously to record an average annual growth rate of 4·7 %. Improvement in productivity was very high at 9·1 % per annum, this being primarily generated by the Italian coastal steelworks, eastern Belgium, North Rhine-Westphalia West and northern France, but even in the other regions the rates were high. Producers reaped the benefit of a very active modernization and expansion policy which expressed itself in a wave of investment culminating in 1963. The work force declined by 2·6 % per annum.

Between 1968 and 1970, production continued to increase at a good average rate (5·3 % per annum), but tended to remain stationary in 1970. Productivity improved more slowly (3 % per annum). The most moderating influences stemmed from the group of Italian coastal steelworks, eastern Belgium and North Rhine-Westphalia West. The work force grew by 2·9 % per annum.

From 1970 to 1973 Community output rose at a lower rate (4 % per annum). The highest rates were achieved in the southern coastal works (8·8 % per annum), southern Belgium (8·6 % per annum) and northern France (6·2 % per annum) and the lowest in North Rhine-Westphalia East (drop of 2·5 % per annum), Saar (2·5 % per annum) and eastern France (0·2 % per annum).

Productivity rose by 5·7 % per annum in the Community in its original composition. This rate was exceeded in southern Belgium, eastern Belgium and North Rhine-Westphalia West. The lowest rates were recorded in the southern coastal works, northern Italy and North Rhine-Westphalia East. The work force increased by 0·8 % per annum.

Taking the period 1965 to 1973 as a whole, Community output is found to have risen by 4·6 % while employment has remained stable. There are however considerable differences from one region to another.

There was an appreciable increase in the work force in the northern and southern coastal regions.

However, the work force declined in North Rhine-Westphalia and eastern France. These long-term trends were accompanied by cyclical fluctuations that also varied from one region to another. The greatest variations were found in regions concentrating on products for the manufacture of capital goods, for example the Saar, Lorraine and southern Belgium. These regions recorded the greatest cutback in output during the 1971 recession and the highest peak activity in 1973.

These brief comments underline the very irregular variations in production and productivity growth rates in both time and space. Roughly speaking, the two rates vary in parallel, but the relationship between their variations is not simple. Investment and the improvement in the quality of manpower have a strong influence on them, as does the state of the market, labour relations and many other factors.

On the whole, in the Community as originally constituted there is a trend towards lower increases in productivity whilst production growth rates remain more or less constant. This trend is indicated in the following table:

	1956 to 1968	1968 to 1973
Production growth rate in %	4·7	4·5
Productivity growth rate in %	5·7	4·6

This trend is at least partly accounted for by the growing proportion of new or completely modernized works in the Community. Other things being equal, progress is less spectacular in a modern unit than in cases where an obsolete plant is being replaced [1].

To give an idea of how the Community stands in relation to the rest of the world, a description of the iron and steel industries in Japan and the United States has been included. A precise comparison is impossible as these two industries comprise products that are outside the scope of the ECSC, such as tubes, nor is it certain that the work force is defined in the same way. Despite these differences, this description shows that great improvements in productivity have been obtained in Japan with the commissioning of large new works.

In the United States, productivity has progressed more slowly, partly because it had already reached a high level in 1965.

(1) It is not excluded that when in future important technical changes occur larger changes in productivity may result.

Trends in production, manning and productivity in Japan and the United States

	1965	1968	1970	1972	1973
JAPAN					
Total work force	320 056	339 760	329 894	320 137	320 661
of which workers	247 367	261 700	253 750	243 929	242 166
Actual working hours per annum and per worker	2 346	2 416	2 309	2 166	2 200
Steel output (million metric tons)	41·2	66·9	93·3	96·9	119·3
Mean % increase per annum	17·6 (1965–1968)	18·1 (1968–1970)	1·9 (1970–1972)	23·1 (1972–1973)	
Total working hours per metric ton steel	18·2	12·3	8·2	7·2	5·9
Mean % improvement per annum	14·0 (1965–1968)	22·3 (1968–1970)	6·8 (1970–1972)	22·0 (1972–1973)	

	1965	1968	1970	1972	1973
UNITED STATES					
Total work force	583 851	551 557	531 196	478 368	508 614
of which workers	458 539	420 684	403 115	364 074	392 851
Actual working hours per annum and per worker	1 976	1 976	1 934	1 955	2 007
Steel output (million metric tons)	122·0	121·0	122·1	123·8	139·6
Mean % increase per annum		— 0·3	0·5	0·7	**12·8**
Total working hours per metric ton steel	9·5	9·1	8·4	7·6	7·3
Mean % improvement per annum		1·5	4·1	5·1	4·1

B — *FORECASTS OF THE WORK FORCE IN 1980*

The period 1968 to 1973 was taken as a basis for estimating productivity in 1980.

Manning developments in 1980 are based on Commission statistics, investment declarations and the corresponding expenditure estimates and information on changes in company structures and equipment taking into account a production potential of 228 million metric tons of crude steel.

The equation E = P × h/H relates the work force *E* to the crude steel output per annum *P*, the number *h* of hours worked by workers and staff per metric ton of crude steel and the number *H* of hours actually worked per annum and per worker and member of staff on the payroll; it is necessary to examine these three components in turn.

1. Steel output in 1980 was estimated on the basis of the expected trends in internal consumption, external trade and production potential.

2. The hours *h* worked per metric ton of steel depend on many factors. The most important are investment projects for modern equipment, either to increase production capacity or to replace obsolete plant, and the improvement in manpower quality. Amalgamations and specialization agreements involving production facilities also play a part as they lead to the shutdown of old units and investment projects. In addition, capacity utilization rates are of considerable importance.

3. To avoid anticipating changes in working hours — the province of both sides of industry and government — use was made of an arbitrary reduction of the duration of work. The estimates of the work force for 1980 have been made on the basis of different assumptions about the reduction of the actual working week in 1980 in comparison with 1973. The following variants have been considered in relation to the different phases of the trade cycle foreseeable for 1980:

   — recession (162 million metric tons): reduction of the actual working week in comparison with 1973 of three and two hours.

   — average economic conditions (170 million metric tons): reduction of the actual working week in comparison with 1973 of two and one hours.

   — boom (183 million metric tons); reduction of actual working week in comparison with 1973 of one and zero hours.

It should be noted that the reductions of the actual working week assumed only constitute a hypothetical basis for the calculations and in no way represent objectives.

Work force in 1980 in the Community under various assumptions

Reduction in actual working week	1973	Low economic activity		Average economic activity		Hig economic activity	
		— 3 hours	— 2 hours	— 2 hours	— 1 hour	— 1 hour	0
F. R. Germany	219 870	201 300	195 700	202 300	196 900	202 000	196 600
North Rhine-Westphalia West	81 742	73 400	71 400	73 600	71 700	75 700	73 800
North Rhine-Westphalia East	59 244	55 300	53 800	54 700	53 200	55 900	54 500
Saar	29 349	29 400	28 600	29 500	28 700	30 500	29 700
France	151 514	142 400	138 400	142 200	138 400	145 500	141 700
Eastern France	79 756	64 700	63 000	64 000	62 300	65 700	64 100
Northern France	35 411	37 000	35 900	37 200	36 100	38 100	37 000
Italy	89 579	91 500	88 600	91 300	88 600	89 900	87 300
North Italy	37 652	37 600	36 400	37 900	36 700	37 500	36 400
Belgium	62 420	55 900	54 400	56 100	54 700	57 000	55 600
Eastern Belgium	22 436	17 500	17 000	17 500	17 100	17 800	17 300
Southern Belgium	31 519	27 300	26 600	27 600	26 900	27 900	27 200
Netherlands	22 954	24 000	23 200	24 400	23 700	25 000	24 200
Luxembourg	22 917	21 700	21 000	21 600	21 000	21 800	21 200
Northern coastal works	55 641	54 900	53 300	54 800	53 200	54 500	52 900
Southern coastal works	45 976	54 500	52 800	54 200	52 600	54 400	52 800
Denmark	2 800 (1)				2 800 (1)		
Ireland	900 (1)				900 (1)		
United Kingdom	200 300				174 200		
England BSC	90 300				82 300 (2)		
BISPA	20 800				20 800 (3)		
Scotland BSC	19 800				16 600 (2)		
BISPA	900				900 (3)		
Wales BSC	61 000				46 100 (2)		
BISPA	7 500				7 500 (3)		
Community	773 254				701 200		

(1) Data for July 1975 for Denmark and Ireland. Since no historical data was available.
(2) Data furnished by BSC from an own investigation, the Commission could not make an estimate due to lack of data. BSC is currently in discussion with the trade unions on accelerated demanning which will substantially change the figures quoted above.
(3) Data for 1973 unchanged for 1980 due to lack of base data for forecast.

The values of *h* were estimated on the basis of average market conditions and the work force calculated from them. The fact that cyclical variations result in an increase in productivity when market conditions are good and a reduction when they are poor was taken as a basis for calculating productivity for poor and good market conditions. The forecasts of productivity are based primarily on historical trends and on planned investment.

For 1980, productivity in the Community as originally constituted, calculated on the basis of the work force, actual working hours and the production of the six original members, amounts to 6·5 hours per metric ton of steel assuming average market conditions and a cut of one hour in actual weekly working hours. It was 8·3 hours in 1973. The mean rate of improvement is therefore 3·5 % per annum.

A comparison of the 1973 situation with the job forecasts for 1980, assuming good market conditions, and a reduction of one hour in the actual working week shows that the work force will increase in particular in the southern coastal works and in northern France while it is likely to drop in eastern France, eastern and southern Belgium and North Rhine-Westphalia.

In the Community as originally constituted, these forecasts result in a reduction of the work force of 28 000 or 4·9 % in comparison with 1973, in the case of a reduction of the actual working week of one hour.

A comparison of numbers employed in 1973 with the case of poor market conditions in 1980, assuming a reduction of the actual working week of two hours, shows a fall in employment of some 48 000 or 8·4 % which reflects in addition to the downward trend the economic conditions. The regions most effected are the same as indicated above. In the case of a reduction of actual working time of three hours per week, the fall in employment would be some 32 000 or 5·7 %.

All the forecasts are subject to some uncertainty due to their depending on estimates made as to steel production and productivity and to the uncertainty of some investments. The forecasts are therefore indications which are based on certain working hypotheses which may prove to be wrong.

This estimate relates to the Community in its original composition. In the case of Great Britain, the BSC expects a reduction of numbers employed in their works of more than 26 000.

The improvement of productivity anticipated by 1980 will result in a reduction of the number of jobs in the steel industry in several regions. In some regions the reduction of employment can largely be achieved through natural wastage. However in other regions natural wastage alone will probably not suffice to balance the posts eliminated in the steel industry and redundancies will prove to be necessary.

Furthermore in the regions as a whole, if all the jobs eliminated in the steel industry are not replaced by new jobs in other sectors, there will be a corresponding reduction in employment opportunities for the young.

The estimate of employment imply significant changes in manpower levels in particular in certain regions. These changes are a necessary condition of the maintenance of competitiveness of the Community steel industry. The reductions of employment must take place within the framework of an appropriate regional and social policy (1).

On the other hand the adaptation of the size of the work force to the needs of the steel industry could be to a large extent limited as a result of the reduction in working hours particularly in periods of recession. The exclusion of this possibility would have the consequence, in these latter periods, of increasing redundancies. This is not a good policy neither from a social nor from an economic viewpoint. In effect if the steel industry resorts to massive redundancies in periods of depression it will encounter in the course of the following boom difficulties in replacing personnel and training them. Indeed for the workers it is less distressing to suffer a period of short-time working than to be made redundant and be obliged to seek a new job.

The experience of the year 1975 has shown that the steel enterprises of the Community have endeavoured to limit redundancies among their personnel in face of the under-utilization of their plant due to the severe recession in the steel trade and that they have resorted largely to the reduction of actual working hours.

(1) See chapter 'Ways and means of a steel policy'.

CHAPTER VII

FINANCING PROBLEMS

A — *HISTORICAL ANALYSIS*

Recently there have been reports on the financing of the steel industry from various quarters, above all the IISI and OECD. On that account we intend to be brief, directing our attention to the real problems. Since the General Objectives are designed to provide guidance for both the private and public sectors, the aim here is not so much to provide a straight description of historical facts as to analyse the problems. The chief purpose then, within a framework of historical analysis, is to identify the difficulties that have arisen in recent years and the causes.

Discussion in what follows will centre first on problems with financing requirements (and the meeting of them) which result from the ups and downs of the trade cycle, and then on structural problems connected with long term borrowing and increased inflation.

Economic conditions affect in a striking manner the steel industry's propensity to invest. Comparison of the rates of growth in steel output (as an indicator of the economic trend) and investment declarations made to the Commission show that times of upswing in the business cycle have coincided with peaks in the propensity to invest; periods of recession have seen a drastic fall in these intentions. In general, the sharper the cyclical fluctuations, the more marked have been the ups and downs in reported investment intentions. In some cases however investment declarations have first reacted to the upswing of steel production with a time-lag of varying length, this being primarily explained by the fact that the propensity to invest is most strongly stimulated when the quantity upswing develops into a price upswing.

Propensity to invest of the steel industry in the Community as originally constituted

	1968	1969	1970	1971	1972	1973	1974	1975
Investment notifications million u.a. (1)	669	1848	3 994	669	770	694	1939	
Annual growth in crude steel output million metric tons	+ 8·7	+ 8·7	+ 1·9	— 5·8	+ 9·8	+ 9·7	+ 9·7	— 20·0
Actual capital spending, million u. a. (2)	802	1 039	1 706	2 266	2 639	2 623	2 522	
Increase of production capacity in million ingot metric tons	+ 2·8	+ 6·1	+ 5·9	+ 8·7	+ 3·9	+ 5·2	+ 8·6	+ 9·5

(1) According to Decision 22/66 of the High Authority altered by Decision 2237/73/ECSC of the Commission.
(2) According to the Annual Report of the Commission 'Investment in the Community coalmining and iron and steel industries'.

Actual investment, however, quite clearly displays a phase-shift with respect to the steel cycle; as a rule it has been high in the recession years and generally lower in the years at the top of the cycle. In the boom year of 1960, investment was a mere 775 million u.a. — in the 1963 trough it was almost 1 500 million u.a. Between 1969 and 1971 the trend was similar. In the boom conditions of 1969 expenditure was no more than 1 000 million u.a. (against 1 700 million in 1970), yet in the depressed trading conditions of 1971 it reached 2 300 million u.a. Consequently, calls for financing were greatest precisely when the market situation was worst. The chief reason for the anti-cyclical pattern of capital expenditure is to be found in the relatively long interval elapsing between the decision to go ahead and completion. Correspondingly, the years in which the market was weak have in general seen the biggest increases in production capacity. Thus, in 1969 and 1970 respectively — both boom years — 6·1 and 5·9 million metric tons were added to crude-steelmaking capacity; in the recession year of 1971, as much as 8·7 million metric tons. In the recent past there has again been a marked anticyclical increase in production capacity — only 5·2 million metric tons in the boom year of 1973 yet almost 9·5 million metric tons in the depressed trading conditions of 1975. It must however be pointed out that development in the different countries and enterprises of the Community can diverge.

Heavy capital spending in recession periods has gone hand-in-hand with falls in both steel output and prices. For that reason, depreciation and retained earnings accounted in 1963 and 1971 for only 40 % and 44 % respectively of total financing requirements compared with over 90 % in the boom period 1969 and 1970. In 1973, too, some 90 % was financed from the same source. (These and subsequent figures relate to the Community as a whole, not including Denmark and Ireland).

Shortage of own resources in periods of peak expenditure has forced the steel industry in periods of recession to contract medium- and long-term debt on a large scale. Thus, in the poor trading conditions of 1962 such debt covered 47 % of total financing requirements and as much as 51 % in 1971, compared with a mere 10 % in the boom period 1969 and 1970. The steel industry has therefore been obliged during times of poor earnings to finance its relatively heavy capital expenditure by increased resort to borrowing. Although such borrowing may be attended by problems, it has nevertheless the advantage that interest rates for borrowings made during periods of economic slowdown are generally lower than in boom periods.

In past years the divergent trends of investment expenditure and availability of own resources have repeatedly led to financing problems and liquidity shortages. In so far as the periods of recession remain short, as in 1971, these problems can be contained within bounds; but they can assume dangerous proportions when the periods of recession lasts for a number of years as was the case in 1965 to 1968. In this situation, developments may take place which can adversely affect the steel industry for some years afterwards.

Indeed, the 1965 to 1968 recession, which moreover was preceded by a very weak upswing in 1964, resulted in long-term structural problems in two respects.

Firstly, in the Community countries (not including Italy, Denmark and Ireland, for which no relevant data are available) the debt ratio (i.e. medium- and long-term debt as a proportion of total capital employed) rose sharply between 1961 and 1968. By 1968 it had reached the danger levels of 67 % and 52 % in France and Belgium respectively.

Debt ratio of the Community steel industry (debt as a percentage of total capital employed)

	1961	1965	1968	1970
Belgium	32	41	52	44
France	55	59	67	63
Germany	29	38	39	32
Luxembourg	0	5	17	14
Netherhands	2	14	17	25
United Kingdom	28	33	44	43

The governments of both countries directed special attention to the resultant problem. In the years 1970, 1973 and 1974 the debt ratio fell in almost all countries.

The second undesirable consequence to flow from the continuing low level of the industry's own resources has been the slowdown in investment activity. Thus, in the period 1966 to 1969, total actual investment expenditure, per metric ton of crude steel output in the steel industries of the Community as originally constituted, was only 12·4 u.a./metric ton, against 23·7 u.a./metric ton in 1960 to 1965 and about 21 u.a./metric ton in 1970 to 1975. (All figures in the foregoing comparison have been adjusted to 1973 prices). The low level of investment that prevailed almost throughout the second half of the 1960s was responsible among other factors for the occurrence of a pronounced shortage of steel in the boom period. This presentation shows how important it is for the long-term development of the steel industry that long periods with insufficient own resources should be avoided.

In total the financing requirements of the European steel industry from the early 1960s to the early 1970s were met chiefly from depreciation.

Increases in share capital made a relatively small contribution.

Financing 1961 to 1971 (1) (2)

	$ Million	%
Depreciation and retained earnings	+ 12 000	60
Medium- and long-term debt	+ 5 900	30
Share capital	+ 2 200	10

(1) IISI Report 'Financing Steel Investment 1960—1971'.
(2) Community without Denmark and Ireland.

The figures in this table are not immediately comparable with figures in other tables of this chapter because of certain differences of definition as for example the inclusion of activities outside the ECSC Treaty in the above figures.

Under Article 54 of the ECSC Treaty, the Commission of the European Communities supplied the steel industry with investment credit amounting to 500 million u.a. ($ 670 million) in 1975. Under Article 130 of the EEC Treaty the European Investment Bank provided 42·4 million u.a. ($ 57 million) in the same year for capital projects in the Community steel industry. This brought these two institutions' contribution to the covering of the industry's financing requirements to approximately 20 %.

In the individual countries of the Community considerable differences are to be found in respect of the importance of the various sources of finance:

In Germany depreciation is by far the most important source of finance, amounting to 78 % of the total between 1961 and 1971. The corresponding figure in Italy was only 27 %. In the other Community countries the share was between 54 and 66 %. The differences are partly attributable to differences in tax law.

It is chiefly in France and Italy that medium- and long-term loans have played an important part (34 % and 43 % respectively); such loans were less significant in Luxembourg and Germany (10 % and 21 %).

Loans from the government or from public institutions are a big element in the UK, Italy, Belgium and intermittently in France, but a very small one in Germany. The steel industry in the Netherlands have not considered loans from such sources. In Luxembourg there are no comparable public lending institutions. These differences are not least explained by the different roles played by these institutions in the capital markets of the five countries mentioned.

Having considered the effects of up and downturns in the economy on the financing of investment we will now turn to two further problems — the influence of the growth in the optimal size of plant and the increasing inflation.

In respect of the growth in size of the various plants it can be stated that almost all stages of productions, i.e. burden preparation, blast furnaces, steel-works, rolling mills and process plant, the optimal unit size has risen considerably during recent years. A well known exception is presented solely by the mini-steel works. Thus considerably more resources are necessary to construct a new or replace old plant than was the case 10 to 20 years ago. For this reason the capital requirements, in particular in the case of construction of new iron and steel plant, can easily exceed the resources of an individual company. There are cases where special difficulties have arisen from such circumstances.

With regard to inflationary price development, we will here discuss a number of basic considerations. The discussion of the quantitative aspects of the future trends in finance requirements and sources of finance will be left to the following section.

The increasing rate of inflation has had and is having a considerable impact on the steel industry's ability to raise funds for investment. Steel companies throughout the ECSC have suffered the adverse consequences of inflation, in particular when high rates of inflation are accompanied by depressed conditions on the steel market. The most important of these adverse consequences are described below.

The first and most obvious effect of inflation is to cause a widening gap between the original cost of equipment and its replacement cost. The depreciation provisions on the original equipment will not be sufficient to enable a steel company to replace it at current prices.

This problem is made worse by the tax laws in the various ECSC countries. Companies are only allowed to charge the original cost of their equipment against tax. The additional revenues which are necessary to enable the company to replace its plant at current prices are treated as profits and taxed as such.

Until recently, it was possible as result of economies of scale to limit this adverse effect of inflation. Now this has become much more difficult for two reasons: first, the rate of inflation continues at a high level in a number of countries, and secondly, the size of most production facilities is approaching the upper limit.

Inflation has also pushed up the cost of labour and raw materials. The result is that a steel company's current assets (steel stocks and accounts receivable) now have a much higher value, and the company has to find additional funds to finance them. This can be done partly by increasing the volume of current liabilities, in particular accounts payable and short term bank borrowings. As inflation increases the amount of working capital required will go up.

This situation is again made worse by the tax laws. Increases in the value of stocks and raw materials are generally taxed as profits when the products are sold. This reduces the company's cash flow and makes it even more difficult to replace current assets at inflated prices.

Under inflationary conditions there is a strong tendency in the capital market for deposit and loan periods to shorten. When inflation is increasing, investors are in general unwilling to make long term commitments at fixed rates of interest. As a result, a proportion of funds is kept on short term deposit or invested in short term securities.

By contrast, the steel industry requires long-term funds. Many items of steel producing plant have a useful life of 15 years or more, but under inflationary conditions the steel industry finds it virtually impossible to raise 15-year funds from private sources. Companies are therefore having to take the risk of borrowing medium term in the hope of re-financing or rolling over the debt after five, eight or 10 years.

Inflation causes very high interest rates which in turn make it very difficult to achieve a reasonable level of profit. If a company has to borrow at a rate of interest of 10 % or more and decides to depreciate its plant over 10 years (10 % per year), it has to make an accounting return of 20 % on capital invested before it can even start to report a profit in its profit and loss account. High interest rates make it difficult for a steel company to achieve accounting profits and therefore difficult to raise share capital.

The equity items in a balance sheet (share capital plus retained earnings) are usually older in date than the debt items which have increased substantially in recent years. The equity items are still recorded at their original money values. As the currency inflates, the equity base has a much smaller relative value than the subsequent debt. Because the equity base does not inflate, the debt/equity ratio rapidly deteriorates in money terms.

However, it would be wrong to claim that all the effects of inflation are adverse; the adverse effects of a high inflation rate are partly offset by the reduction of the burden of existing debt, as steel prices increase.

B — *FUTURE CAPITAL REQUIREMENTS AND SOURCES OF FUNDS*

This section is divided into two parts. The first part contains an estimate of the amount of funds which will be required to finance the European Community steel industry's capital investment and working capital during the periods 1974 to 1980. The second part analyses the quantities and proportions of funds which can be supplied by the different sources of funds. Note that, except for the subsection on the effect of inflation, all money figures in this section are in units of account at constant 1973 prices.

The following analysis is based on historic ratios and on estimates prepared for other chapters of the General Objectives. In those cases where no data was available, it has been necessary to make a number of assumptions.

Capital requirements 1974 to 1980

The main difficulty in estimating the steel industry's future capital expenditure is the large and unknown volume of expenditure on replacement and modernization. It would be relatively easy to calculate the investment cost of installing net new capacity in order to achieve the required level of capacity required to meet the General Objectives in 1980. But these figures would not take into account the heavy volume of expenditure on replacement and modernization of old capacity which is continually taking place. Moreover, it is virtually impossible to forecast the future level of expenditure on replacement and modernization because this depends heavily on the future balance of capacity and demand, and on the financial condition of the steel industry. Steel companies will tend to spend more on replacement and modernization during good trading conditions than during a recession when they must conserve their resources.

It has been assumed that the volume of expenditure on replacement and modernization will bear the same relationship to the volume of expenditure on net new capacity during 1974 to 1980 as it did during 1966 to 1973 in the six original members of the Community.

The following table has been calculated on this assumption. According to this calculation, the total volume of capital expenditure by the steel industries of the nine member countries during the seven years 1974 to 1980 will be about 14·6 billion units of account (at constant 1973 prices). This is equivalent to an annual rate of nearly 2·1 billion u.a.

A company's working capital is equal to its current assets minus its current liabilities. For this reason it can also be called 'net current assets'.

The requirements for working capital, which are calculated in the following table, constitute a part of the total capital requirements.

It is difficult to forecast the future level of working capital because current assets and current liabilities are both very volatile. Working capital is the difference between them and therefore even more volatile. Moreover, working capital is normally calculated at the balance sheet date, but the amount required may be considerably greater at other times during the year. Working capital can also fluctuate because of management decisions.

1974 to 1980 global calculation of capital expenditure in the Community steel industry

	EUR 6	EUR 9
	1966 to 1973 Capital expenditure million u.a. at constant 1973 prices	1974 to 1980 Forecast capital expenditure (1) million u.a. at constant 1973 prices
Steelworks owned Coking plant Burden preparation & direct reduction Blast furnaces	3 183	3 334
Steelworks (all processes)	2 122	2 152
Continuous casting Blooming & slabbing mills Section mills Flat product mills Including coils Finished products Rolling mills Auxiliary plant	6 686	6 427
General services	2 700	2 687 (2)
Total	14 691	14 600

(1) For the capacities established in the equilibrium of the supply and demand (eg. 215 million metric tons for crude steel production).
(2) 18·4 % of total expenditure.

For example, it will increase sharply if management decides to manufacture for stock in order to prevent redundancies during a downturn in the steel cycle.

Although the steel industry's working capital requirements will continue to be rather unpredictable, they will certainly need to increase between 1974 and 1980. The additional amount of working capital required will depend on the steel industry's future level of sales and on the ratio of sales to working capital. The ratio of sales to working capital for the steel industries of the Community has been estimated to be 6·6, based on historic ratios from the period 1961 to 1973.

It is estimated that the sales revenues of the Community steel enterprises will grow from 25·3 billion u.a. in 1973 to about 28·7 billion u.a. in 1980, an increase of 3·4 billion u.a. (all these figures are at constant 1973 prices). If the sales/working capital ratio of 6·6 continues during these seven years, the additional amount of working capital required will be approximately 500 million u.a. and the average increase will be about 75 million u.a. The most striking fact about this figure is its very small size in relation to the forecast capital expenditure of nearly 2·1 billion u.a. per year. There are two reasons for this. Firstly it is clear that most of the required increase in raw materials, steel stocks and receivables will be financed by a similar increase in current liabilities including short term borrowings. Secondly, all the above figures exclude inflation. In a later sub-section it will be shown that if there is a high rate of inflation, a major increase in working capital will be required.

Sources of funds 1974 to 1980

In order to calculate the steel industry's future sources of funds, it is necessary to make the following assumptions:

- the steel cycle is excluded from the calculations. It is assumed that the total capital expenditure of 14·6 billion u.a. will take place in equal annual amounts from 1974 to 1980; and that crude steel production will increase in equal annual steps from 150 million metric tons in 1973 to 170 million metric tons in 1980,
- the industry's total sales have been calculated by using the 1973 sales revenue of 169 u.a. per metric ton of crude steel. Note that sales revenue per metric ton is not the same as the price of crude steel,
- all money figures in these calculations are at constant 1973 prices, excluding inflation,
- the operating profit (1) has been estimated at 11·7 % of sales. This is a weighted average percentage which has been derived from historic figures reported by the Community steel enterprises during the period 1961 to 1973. It is assumed that this percentage will continue into the period 1974 to 1980,
- the depreciation method for new fixed assets is assumed to be straight line depreciation over a period of 15 years,
- the interest rates on new debts have been estimated, in the light of the assumptions concerning the development of inflation, at 5 %, 9 % and 13 % for inflation rates of 0 %, 5 % and 10 % respectively. These are average rates for all the countries of the Community and do not constitute in any way an economic forecast.
- the calculations include a standard tax rate of 50 % and a dividend payout ratio of 75 % of profits after tax. During the period 1961 to 1971 the dividend payout ratio for the Community steel industry as a whole was about 100 %,
- it is assumed that the historic sales/working capital ratio of 6·6 will continue into the future.

On the basis of these assumptions the Community steel industry's capital requirements and sources of funds during the period 1974 to 1980 are estimated as follows:

(1) The operating profit is defined to be gross profit before deduction of depreciation, interest charges and taxes.

Capital requirements 1974 to 1980

(million u.a.)

Capital expenditure	Working capital	Total capital requirements
14 600	500	15 100

These estimates must be read subject to two important reservations. Firstly, they are global estimates for the Community as a whole and there will obviously be major differences from country to country and from company to company. The main factors causing these variations in performance will be different levels of profitability and different levels of capital expenditure.

Sources of funds 1974 to 1980

	Retained earnings	Depreciation	Share capital	Debt	Total sources
Million u.a.	320	12 500	750	1 530	15 100
Per cent	2 %	83 %	5 %	10 %	100 %

Secondly, the calculations exclude inflation. As a result, the figures are too favourable. For example, they show that 83 % of capital requirements can be met from depreciation and that debt will be required to cover only 10 % of all funds. Later in this chapter it will be shown that when inflation is taken into account, the financing gap is much larger and more difficult to fill.

According to the calculations, retained earnings are expected to make only a small contribution to total funds. This is because of the low operating profit margin (11·7 %), the 50 % tax charge, and the high dividend payout ratio (75 %). The proportion of funds provided by retained earnings will remain small unless the operating profit margin can be increased and the dividend payout ratio is reduced.

The main limiting factor on the steel industry's ability to use debt to fill its financing gap is its ratio of debt to total capital employed. On the same assumptions as those used in estimating future sources of funds (i.e. excluding inflation) it is calculated that during the period 1973 to 1980 the Community steel industry's debt ratio will remain at about its 1973 level of 51·2.

The effect of inflation

All the data so far shown in this section has been at constant 1973 prices. It is now necessary to take into account the impact of inflation.

Inflation has two main effects on a steel company's financial position. Firstly, it increases the cost of new plant and of replacing old plant. It therefore becomes increasingly difficult to finance new capital expenditure out of historic depreciation charges and more long term capital has to be raised from external sources. Secondly, inflation requires a substantial increase in working capital. The next table shows, as an example, the effect of a 5 % and 10 % rate of inflation on the Community steel industry's future capital requirements:

Capital requirements 1974 to 1980

(million u.a.)

	Capital expenditure	Working capital	Total capital requirements
Constant 1973 prices:	14 600	500	15 100
5 % inflation	17 800	2 300	20 100
10 % inflation	21 800	4 600	26 400

Although inflation forces up the level of capital requirements, it does not automatically increase a company's sources of funds. It should be possible to increase operating profits in line with the rate of inflation but even if this happens, the increased operating profit will be taxed as profit and may be paid out in dividends.

The net increase in retained earnings is therefore not sufficient to compensate for the inflation of working capital and fixed capital requirements. The following tables show the dramatic effect of inflation on sources of funds:

Sources of funds 1974 to 1980

(million u.a.)

	Retained earnings	Depreciation	Share capital	Debt	Total sources
Constant 1973 prices:	350	12 500	750	1 500	15 100
5 % inflation	800	13 100	1 000	5 200	20 100
10 % inflation	1 220	13 860	1 320	10 000	26 400

(percentages)

	Retained Earnings	Depreciation	Share Capital	Debt	Total Sources
Constant 1873 prices:	2	83	5	10	100
5 % inflation	4	65	5	26	100
10 % inflation	5	52	5	38	100

Ratio of debt to capital employed

(percentages)

	Constant 1973 prices	5 % inflation	10 % inflation
1973	51·2	51·2	51·2
1974	51·7	52·1	52·6
1975	51·9	52·9	53·9
1976	52·0	53·9	55·3
1977	52·1	54·4	56·8
1978	52·1	55·2	58·3
1979	52·0	55·9	59·7
1980	51·8	56·6	61·2

The preceding figures indicate that if the rate of inflation is near to 10 % during the next five years, then a large financing gap will probably develop and the debt/capital employed ratio is likely to increase. There is no theoretical maximum for the debt/capital employed ratio. The ability to increase this rate depends on the lender's willingness to lend. But as the ratio continues to increase, the question arises as to whether the steel industry and other industries in a comparable situation will have private capital at their disposal. The answer will vary greatly from country to country and from company to company but if the debt ratio continues to increase, then the danger remains that steel companies will become more and more dependent on loans from national governments and other public sources. There is also the danger that some companies will have to adopt the other alternative of restricting their capital expenditure.

The abovementioned figures have been based on the assumption that steel prices, production costs and the price of capital goods will all inflate at the same rate. The results would of course be substantially worse if steel prices increased at a lower rate than the other two. During 1975 steel companies have suffered from the fact that steel prices have fallen considerably while production costs and the price of capital goods have continued to rise. Continuation of this trend would have a disastrous effect on the steel industry's future financial position.

On the other hand it cannot be excluded that, in periods of high demand, steel prices will rise faster than the general level of inflation, as in 1973 and 1974. This would have the advantage for the steel industry of increasing at the same time its ratio of operating profits to sales.

The preceding analysis shows very clearly how crucial it is for the industry that continued efforts should be made to cut inflation back to a reasonable level; both this and the evolution of the operating profit margin determine in the final analyses the credit rating and the degree of self-financing of the steel industry.

CHAPTER VIII

RAW MATERIALS

During the reconstruction period and up to the end of the Fifties, raw material supplies were a major problem for the iron and steel industry. The situation changed somewhat during the Sixties. During that decade most raw materials were available in adequate quantities and at relatively low prices. The market was occasionally stretched fairly tight, but only for short periods when economic conditions were good. In 1973 and 1974 the steel industry experienced persistent supply difficulties in the way of shortages and high prices, mainly as a result of the energy crisis and the very rapid rise in world prices for raw materials. Consequently it appears essential to prepare detailed forecasts of resources and future requirements of the main raw materials used in the steel industry.

The starting point for any determination of future raw material requirements is a forward estimate of steel output by steelmaking process. Based mainly on the estimates of production potential, the breakdown of steel output by steelmaking process forecast for 1980 is shown in the following table:

Breakdown of Community crude steel output by steelmaking process as forecast for 1980

Process	1973		1980			
			average trend		upper limit	
	million metric tons	% of total	million metric tons	% of total	million metric tons	% of total
Basic Bessemer	13·3	9·0	0·7	0·4	0·7	0·4
Open hearth	25·3	16·8	10·9	6·4	11·7	6·4
Electrical	22·8	15·2	35·0	20·6	37·7	20·6
Oxygen	88·5	59·0	123·4	72·6	132·9	72·6
Total	150·1	100	170	100	183	100

A — *PIG-IRON*

Pig-iron requirements for 1980 will be governed by:

— pig-iron consumption in steelmaking plant,

— pig-iron consumption in foundries,

— net balance of external trade in pig-iron.

Pig-iron consumption in steelmaking plant will depend mainly on the breakdown of steel output by steelmaking process and the specific consumption in each process.

Specific consumptions have been estimated in conjunction with the scrap charging forecasts since these materials are complementary in steelmaking plant.

The table below shows the assumptions that have been adopted in estimating pig-iron consumption in 1980.

Community consumption and production of pig-iron (1)

	Basic Bessemer	Open hearth	Electrical	Oxygen	Total
1973					
— Total consumption	13·7	10·4	1·1	76·1	101·3
1980					
— Specific consumption in kg/metric ton					
Average trend	940	360	30	870	665
Upper limit	940	380	30	880	673
— Total consumption in steel-making plant					
Average trend	0·7	3·9	1·1	107·4	113·1
Upper limit	0·7	4·4	1·1	117·0	123·2
— Consumption in foundries in 1980					
Average trend					5·8
Upper limit					6·3
— Net trade balance in 1980					
Average trend					— 0·4
Upper limit					— 0·4
— Pig-iron production in 1980					
Average trend					118·5
Upper limit					129·1

(1) Including carburized ferromanganese and spiegeleisen.

The differences between the specific inputs taken for the average trend and for the upper limit are obtained from the estimates made for scrap charging. It appears reasonable to expect a slight increase in specific pig-iron consumption over the 1973 and 1974 figures for the upper limit. This increase will be analysed in detail in the chapter on scrap.

Foundry requirements were estimated in the study summarized at the end of this chapter. The consumption figures adopted for 1980 are 5·8 million metric tons for the average trend and 6·3 million for the upper limit.

Finally, a net external trade deficit of 0·4 million metric tons was adopted. This corresponds to the average of the last few years.

B — *SCRAP*

Everything that was said about raw materials in general at the beginning of the section on supplies is particularly pertinent to scrap.

There were serious shortages on the scrap market during the Fifties but the situation improved considerably in the Sixties.

These long-term trends were mainly due to structural factors, in particular the shares of steel output accounted for by the different steelmaking processes, trends in external trade in iron and steel products, trends in final steel consumption, etc.

These trends were accompanied by extensive cyclical fluctuations, the amplitude of which appears to have been increasing in the past 15 years.

The reasons for the sensitivity of the scrap market must be sought in its structure, in particular in the relative trends in the three main scrap sources during the different phases of the trade cycle.

In a period when steel output and scrap requirements are increasing rapidly:

— the steel industry's own circulating scrap (representing about half of total resources) is recycled almost immediately and there is little change in its relative volume,

— process scrap from the user industries, making up about 20 % of total resources, does not keep pace with demand because of the normal time lags between steel production and its fabrication by users and delays in scrap collection. Consequently, the relative share of this scrap tends to decline temporarily,

— there is therefore an increased demand for capital scrap (about 30 % of total resources). The trade steps up collection by drawing on 'outlying' stocks that had been ignored in the previous period of poor market conditions. The resultant increase in costs is passed on to the market as a whole.

In a period when steel production and consumption and scrap requirements are contracting, most of these phenomena are reversed:

— circulating scrap in the steelworks continues to follow production trends fairly closely,

— because of the time lags already mentioned, the rate at which process scrap from the user industries reaches the market is governed by the volume of steel consumption in the preceding period and consequently its relative share increases slightly,

— this results in a more than proportional reduction in the demand for capital scrap.

These automatic effects are accompanied by the effect of stock variations, changes in specific consumption, forward or late buying and efforts to hold back stocks at times when prices are fluctuating rapidly.

All these factors always act in the same direction in each phase of the cycle and largely account for the sensitivity of the scrap market.

1. **Forecast of scrap requirements for 1980**

Future scrap requirements in the steel industry will, as in the past, be governed by:

— consumption in steelmaking plant,

— consumption in rolling mills for rerolling,

— consumption in blast furnaces.

Consumption in steelmaking plant will remain by far the largest item and will depend mainly on trends in specific consumptions by steelmaking process and the shares of the different processes in total steel output.

A forward analysis of these two factors has been carried out at a very detailed level (by process and by country); taking an overall view, the trends ascertained result from a number of different tendencies often having conflicting effects.

Specific scrap input by process and by country in general tended to increase very slightly from 1960 to 1972. In 1973 and 1974, however, appreciable reductions were recorded because of the tight situation on the scrap market.

The possibilities of replacing scrap by pig-iron in steelmaking plant have helped to keep the Community steel industry supplied without any adverse effects on production levels.

Steelworks' scrap requirements for 1980 have been calculated on the basis of the expected trends in the shares of the different steelmaking processes in total output and the estimated figures for specific scrap input.

The assumption made on scrap inputs in the case of average market conditions for 1980 and 1985 by country and process are based effectively on the maintenance of actual specific consumptions achieved in 1973, and for the upper limit on the specific consumptions of 1974. The differences which appear at Community levels in the tables derive essentially from the changes in the structure of production and the balance of steelmaking processes by country.

It is possible that there will be some reduction in the inputs estimated for average trends for the oxygen processes as a result of techno-economic factors such as the proportional drop in the output of phosphorus pig-iron and the difficulty of locating scrap on the market with suitable physical and chemical characteristics to make up for the reduction in circulating scrap in steelworks which have introduced continuous casting.

On the other hand it cannot be exluded that the specific consumption in 1980 in the oxygen processes may be somewhat higher than in the years 1973 and 1974 since from the technical point of view there is nothing against such an increase in the input of scrap. The second assumption foresees therefore an addition of 10 kg in scrap inputs in comparison with the first assumption.

The following table shows estimated scrap requirements for steelmaking use for 1980:

Specific and total scrap consumption in steelworks

	Basic Bessemer	Open hearth	Electric	Oxygen		Total	
1973							
Specific consumption kg/metric ton	131	672	1 011	255		429	
1980				*Assumption*			
Specific consumption kg/metric ton				1	2	1	2
Average trend	200	720	1 030	250	260	440	448
Upper limit	200	700	1 030	240	250	430	436
Total consumption million metric tons							
Average trend	0·1	7·8	36·1	30·8	32·0	74·8	76·0
Upper limit	0·1	8·2	38·8	31·9	33·2	79·0	80·3

As far as scrap demand for blast furnaces is concerned, the trend towards a reduction in specific consumption should continue. The large modern blast furnaces whose operating and charging techniques do not generally allow scrap to be charged will account for an increasing share of total pig iron procuction.

An assumption of 1·8 million metric tons for the average trend and 2·0 million metric tons for the upper limit has been adopted for scrap consumption in blast furnaces in 1980 (compared with 2·24 million metric tons in 1973). Scrap consumption for rerolling should remain at about the same level in 1980 as in 1973, i.e., about 0·5 million metric tons.

2. Forecast of scrap availabilities in 1980

In surveying scrap availabilities it is necessary to analyse the various sources separately.

They are:

— circulating scrap in the steel industries,

— process scrap in the steel user industries,

— capital scrap.

Very little circulating scrap is marketed: its volume is closely linked to steel output levels. The other two sources are two separate markets influenced by different factors.

Circulating scrap

The rate of scrap arisings in the steel industry has remained relatively constant during the Sixties. The different factors affecting it have more or less cancelled each other out in the past.

The continuous casting process started to expand in 1970 and will show a rapid rate of increase up to 1980. Continuous casting production potential should rise from 19·1 million metric tons in 1973 to 64·1 million metric tons in 1980. To allow for this trend when assessing circulating scrap in the steel industry, steel output forecast for 1980 has been divided into continuously cast steel and ingot steel. Continuous casting output has been estimated by applying to production capacity the same utilization rates as for crude steel in general, thus assuming that capacity utilization in this type of plant will improve — up to now it has remained well below the level for crude steel as a whole. Ingot output has been calculated by subtraction. Circulating scrap in the steel industry has been obtained by applying the following scrap rates to the two types of production: 11 % for continuous casting and 20·1 % (i.e., slightly below the 21·1 % recorded in the Community of Six in 1971 to 1973) for normal casting.

To obtain a total for the steel industry's own resources directly linked to production, two corrections were made:

— one for sprue and other casting scrap of non-alloy iron (0·1 % of iron production),

— one to allow for the difference between the scrap rate of independent steel foundries and that adopted for ingot steel production.

The ECSC steel industry's own scrap arisings

(million metric tons)

	1973	1980	
		Average trend	Upper limit
Crude steel			
1. Production	150·1	170	183
2. Production potential	174·5	228	228
3. Utilization rate (1:2)	86·0	74·6	80·3
Continuous casting			
4. Production potential	19·1	65·7	65·7
5. Utilization rate (—3)	74·9	74·6	80·3
6. Production (4 × 5)	14·2	49·0	52·7
7. Scrap yield ratio	11·0	11·0	11·0
8. Scrap (6 × 7)	1·6	5·4	5·8
Ingot casting			
9. Production (1—6)	135·1	121	130·3
10. Scrap yield ratio	21·1	20·1	20·1
11. Scrap (9 × 10)	28·7	24·3	26·1
12. Sprue and casting scrap of pig-iron	0·1	0·1	0·1
13. Correction for independent steel foundries	0·4	0·4	0·4
14. Total scrap (8 + 11 + 12 + 13)	30·8	30·2	32·4
15. Average scrap yield ratio	20·5	17·8	17·8

Process scrap from the steel user industries

Process scrap is of fundamental importance to steelworks mainly because of its quality. With the exception of turnings, process scrap has been and will remain one of the most valued forms of scrap, especially in certain types of production where it is virtually irreplaceable. The flow is regular, apart from a slight tendency for the steel user industries to hold back supplies at certain periods, and the supply can be calculated from steel consumption.

Up to now availabilities of process scrap have been calculated rather imprecisely from sometimes disparate statistical sources and information mainly of a qualitative nature. Inevitably there has been a high margin of uncertainty. What is more, the uncertainty in the calculation of process scrap arisings has been reflected in the estimates of capital scrap, leading to incorrect figures for this sources of supply.

It was therefore found essential to make a detailed analysis of scrap arisings in the Community steel user industries. The Commission then charged three independent experts with the execution of a specific study on scrap yield ratios by sector in Germany, Italy and the United Kingdom; the sectors were defined in accordance with SOEC questionnaire 2—73.

This work was done in close cooperation with the trade associations and with the Commission departments and produced three sets of scrap yield ratios for the main sectors. These were finalized on the basis of data collected by Commission staff and weighted in terms of steel consumption by sector in the different countries. The following table shows the scrap yield ratios which have been adopted for the Community as a whole:

Average scrap yield ratios in the Community steel user industries for 1972 (1)

11. Steel foundries	5·0
12. Forging and pressing	25·5
13. Steel tube	11·2
14. Wire drawing	5·8
15. Bright drawing	6·6
16. Cold rolling 17. Manufacture of cold formed shapes	8·0
18. Deep drawing & cutting	20·7
20. Machinery (non-electric)	31·2
30. Electrical machinery	27·5
41. Shipbuilding	13·1
42. Locomotives & wagons	12·5
43. Automobiles, cycles & other vehicles	36·4
51. Structural steelwork	6·3
52. Other building & public works	4·0
60. Rail tracks	0
71. Metal furniture	11·2
72. Screws, nuts, bolts	17·3
73. Hardware, cutlery	19·9
74. Metal packaging	12·4
75. Metal drums	9·0
76. Boilers & other metal containers	10·4
77. Precision engineering, etc.	46·7
80. Mining	2·5
91. Steelworks own consumption	4·6
Overall rate (2)	15·6

(1) These rates represent the ratio between total scrap in the sector and the consumption of products coming under the ECSC Treaty. For steel foundries, only scrap obtained from the finishing of castings has been included, as scrap occurring between the molten phase and the rough castings is included in steelworks circulating scrap.
(2) Not including scrap at the level of steel stockholders.

Past and foreseeable trends in the average scrap yield ratios have also been analysed. Three factors have had and will continue to have a major influence on this rate:

1. Variations in the structure of steel consumption from one sector to another.

2. Technical developments in the fabricating industry and changes in the products made.

3. The degree of integration of the undertakings. Here large variations in the scrap yield ratio in one sector are generally accompanied by variations in the opposite direction in other sectors or in the steel stockholdings trade.

To analyse the effects of past trends in the structure of steel consumption, the ratios adopted for each sector were applied to the consumption of that sector in the last ten years.

This showed that the average scrap yield ratio remained more or less constant despite variations in the structure of steel consumption. Data collected on other factors indicated that the reduction in the average scrap yield ratio over the last 10 years has been between 0·7 and 1 % depending on the country concerned and is likely to be 0·5 % up to 1980 and 0·5 % from 1980 to 1985. Consequently it appears reasonable to adopt an annual fall of 0·1 % in this study. The average ratios were finally corrected by the scrap obtained in the steel stockholding trade. A survey undertaken by the Commission departments resulted in the adoption of a correction factor of 0·2 % for the average overall scrap rate. In the stockholding trade the scrap yield

The method and coefficients used in forecasting process scrap from the user industries are shown in the two tables below.

ratio is about 2 % of the tonnage of steel products handled.

Process scrap in the Community steel user industries

Sectors	Scrap yield ratio 1972 %	Estimated consumption 1980 (million metric tons) Rolled products	Uncorrected scrap 1980 (1) (million metric tons)
11. Steel foundries	5·0	2·3	0·12
12. Forging and pressing	25·5	5·1	1·30
13. Steel tube	11·2	18·5	2·07
14. Wire drawing	5·8	8·1	0·47
15. Bright drawing	6·6	3·0	0·20
16. Cold rolling 17. Manufacture of cold formed shapes	8·0	6·5	0·52
18. Deep drawing & cutting	20·7	2·0	0·41
20. Machinery (non-electric)	31·2	12·4	3·87
30. Electrical machinery	27·5	3·5	0·91
41. Shipbuilding	13·1	4·2	0·55
43. Automobiles, cycles & other vehicles	36·4	12·7	4·62
51. Structural steelwork	6·3	7·6	0·48
52. Other building & public works	4·0	13·9	0·56
73. Hardware, cutlery	19·9	5·8	1·15
74. Metal packaging	12·4	3·7	0·46
76. Boilers & other metal containers	10·4	5·2	0·54
Other	10·1	13·8	1·41
		128·3	19·64

Uncorrected average scrap rate for 1980:	19·64 : 128·3 = 15·3 %
Correction to allow for stockholders' scrap	+ 0·2 %
Correction to allow for foreseeable technical development	— 0·5 %
Corrected average scrap rate for 1980	15·0 %

(1) Upper limit.

Process scrap in the steel user industries

(million metric tons)

	1973	1980	
		average trend	upper limit
Steel consumption (1)	100·4	120·5	128·3
Scrap yield ratio (%)	15·7	15·0	15·0
Process scrap	15·8	18·1	19·3

(1) In million metric tons of rolled products.

Capital scrap availability in 1980

The forward estimate of availability of 'capital' scrap for 1980 and 1985 has been based on the hypothesis that the volume of 'capital' scrap in any one year is a function of the final consumption of steel (1) during a year or period in the past (this time-lag being a measure of the average length of life of iron and steel containing manufactures or structures) and of scrap prices in the year under consideration. This can be alternatively expressed in the following manner:

$F_n = a + b{\cdot}f\,(C_{n\text{-}k}) + o{\cdot}f\,(P_n)$

where

F_n = the availability of 'capital' scrap in year *n*

$f(C_{n\text{-}k})$ = a function of final steel consumption in the year *n-k*

$f\,(P_n)$ = a function of scrap prices in year *n*.

This model has been statistically calibrated using two series of annual data, one being for the Community in its original composition and the other for the United Kingdom.

The base data on the availability of 'capital' scrap, covering the years 1965 to 1974 inclusive for the two series was determined in the following manner:

— the statistical series for overall scrap requirements was verified taking into account consumption of scrap by the steelworks, blast furnaces and rolling mills plus variations in stocks at the works and the net balance of external trade,

— 'circulating' scrap in the steel industry and 'process' scrap from the user industries were deducted from the above global data to give the steel industry purchases of 'capital' scrap,

— the purchases of 'capital' scrap calculated in the study 'Iron Foundries' was then added to the above figure. The resultant total represents the total volume of 'capital' scrap recovered and recycled within the Community.

All data used in these calculations for the six original member countries of the Community conformed with the definitions laid down by the Statistical Office of the European Communities while that for the United Kingdom followed the definitions of the British Steel Corporation in order to permit the formulation of a series (the necessary statistics for the new member countries conforming with the definitions of the Statistical Office of the European Communities exist only from the year 1973). This difference in definitions resulted in a divergence for the year 1973 between the Community totals for 'capital' scrap based on the Statistical Office definitions and the sum of the two series used in this exercise, the former being greater than the latter. A correction factor based on this difference in 1973 was calculated and later applied to the forecasts in order bring them into conformity with the definition of the Statistics Office so that further calculations can be carried out at Community level.

The two statistical series for final steel consumption in the six original member countries of the Community and for the United Kingdom were derived by the Statistical Office of the European Communities. The statistical calculations were carried out using the base annual date and three-year and five-year moving averages of the annual series on final steel consumption. The latter two were introduced because the amplitude of the series on 'capital' scrap is significantly smaller than that of the final consumption series. For example the standard deviation of the former series for the six original member countries of the Community is some 39 % of the series mean value whereas that of the steel consumption series is over 61 % of its mean value. In other words the availability of 'capital' scrap is much less sensitive than final steel consumption to changes in the level of economic activity. Thus, to make forward estimates on the basis of the annual final steel consumption would introduce an unjustified volatility into the forward estimates for 'capital' scrap. The moving average is a device for damping the amplitude of the final steel consumption and therefore eliminating such volatility in the forward estimates. In addition to linear functions of the three base series outlined above two non-linear functions of the series were tested. These were the square of the series on final steel consumption and the natural logarithms of this series.

The data series on price was based on published monthly prices. For the six original member countries three series were assessed, namely the price of category 03 scrap free Basle and free Modane plus the US composite price for category HMl at the end of each month.

For the UK the price for category 02 scrap was employed. Since the data for 'capital' scrap and final steel consumption were annual series it was necessary to define a single parameter from the monthly price series, a parameter which would give the best explanation of the variations in the 'capital' scrap series. In fact four parameters were statistically tested, namely the average annual monthly price, the

(1) Final consumption of steel is defined as follows:
Steel production + scrap consumption in rolling mills + steel imports (direct and indirect) — steel exports (direct and indirect) ± variations in stocks (works and stockholders). Indirect imports/exports measure the steel content of manufactured goods/structures imported into or exported from a country/area.

maximum monthly price recorded during the year, the price at the end of June in each year the prices at the end of December. As with the final consumption both linear and the two non-linear functions of the price series were tested.

The calculations were carried out in two stages. First the optimal time-lag between the series for final steel consumption and 'capital' scrap was determined. In effect we are determining in this calculation the average life of the steel containing products and structures which form the constituent parts of the final steel consumption series. In the second step price was introduced as a variable into the equation with final steel consumption lagged by the number of years determined in the first calculation. The optimal time-lag between the two series was 13 years for the six original member countries of the Community and 17 years for the United Kingdom, i.e. the average life of manufactured goods and structures of iron and steel is 13 years in the six original member countries of the Community and 17 years in the United Kingdom.

In the second stage, the calculations show that for the six original members of the Community the best results are obtained with a function consisting of a five-year moving average of final steel consumption with a time-lag of 13 years against the 'capital' scrap series and the natural logarithm of a series consisting of the highest monthly price free Basle recorded during each year. The equation obtained was as follows:

$$F_n = 7{\cdot}92527 + 0{\cdot}15104\ C_{n-13} + 2{\cdot}57090\ \log_e P_n$$

where

F_n = availability of 'capital' scrap in year *n* in million metric tons

C_{n-13} = five-year moving average of final steel consumption in million metric tons centred around the year *n-13*

P_n = the maximum monthly price recorded free Basle during the year *n* in 100 DM/metric ton

n = 0, 1, 2, 3 . . . . . n

The multiple correlation coefficient associated with this equation was 0·985 and the standard error of estimate was 0·4 million metric tons.

In the case of the United Kingdom the first indicators from the second-stage calculation showed a significant negative correlation between both dependent variables and the independent variable and provided an excellent description of the historical development of the 'capital' scrap market. It was decided at this stage not to proceed further with the calculations for two reasons. These were as follows:

— the negative partial correlation coefficients are doubtless a reflection of the general slowdown in economic activity in the United Kingdom and in particular the low level of investment in new plant and equipment in recent years with the consequent reduction in the rate of scrapping of old plant and equipment. However the estimates for 1980 to 1985 of steel consumption and production were based on macro-economic indicators which show a reversal of this trend. Thus it would be illogical to formulate an estimate of 'capital' scrap availability which implicitly assumed a continuation of the historical development,

— neither would it be sensible to assume that the circumstances where quantity is inversely related to price might continue to be valid in the future.

As an alternative the relationship between the series for 'capital' scrap and that for final steel consumption with a time-lag of 17 years has been examined. This indicated that the rate of recuperation of scrap declined suddenly at the beginning of the Seventies but has, if the exceptional years of 1974 is excluded, tended to stabilize at or about this new level. Furthermore the estimates for steel production and consumption in 1980 have been based on, among other factors, an increase in the level of investment with no doubt a consequent increase in the rate of scrapping of old installations and structures. In such circumstances it would not seem unreasonable to assume that the rate of recuperation will at least stabilize around current levels. Thus, for our 1980 forecast, we have taken the average rate of recuperation in the years 1971 to 1973 inclusive and applied this factor to a five-year moving average centred on 1963 of the final consumption series.

For 1980 the econometric relationship for the six original member countries of the Community gives a 'capital' scrap availability of 21·5 million metric tons, an increase of 2·7 million metric tons over 1974.

This estimate was derived using five-year moving average centred on 1967 of the final consumption data and the price level of 1974 used to establish the econometric relationship. This price level was finally selected after an examination of the implications of alternative assumptions on price for the equilibrium of supply and demand of scrap in the Community. When considering the rate of increase of scrap availability over the period 1974 to 1980 one should bear in mind the exceptional nature of the year 1974 in particular with respect to scrap prices. In the period 1965 to 1974 the 'capital' scrap availability increased by some 5·7 million metric tons. A simple calculation with the econometric model indicated that approximately 3·4 million metric tons of the increase can be attributed to the growth in volume of material available for scrapping while the remaining 2·3 million metric tons resulted from the enormous increase in prices over the period. Thus, if prices had remained constant throughout the period 1965 to 1974, scrap availability would have increased at a rate of *ca* 2·1 % per annum in the six original member countries of the Community in these years. The estimate for 1980 made at 1974 prices by contrast show an increase of 2·3 % per annum.

In the case of the United Kingdom the alternative method results in a 'capital' scrap availability of nine million metric tons in 1980 (against 8·96 million metric tons in 1970 and 7·49 in 1974).

Thus in 1980 the total availability of 'capital' scrap in the six original member countries of the Community plus the United Kingdom is estimated at 30·5 million metric tons. After deducting the estimated requirements of the foundries as indicated by the study 'Iron Foundries' and making the statistical adjustment mentioned earlier one arrives under average economic conditions at a 'capital' scrap availability of 25·6 million metric tons for the Community steel industry in 1980.

All the preceding remarks have related to a situation of average economic activity. In the case of high economic activity the estimate of total 'capital' scrap availability in 1980 would increase to 32·2 million metric tons. With the adjustment for the foundries and statistical compatibility the availability of 'capital' scrap for the Community steel industry would be 26·6 million metric tons in 1980.

Forward estimate of iron and steel requirements and availabilities

	1973	1974	1980			
			average trend		upper limit	
			Assumption		Assumption	
			1	2	1	2
Apparent consumption in steelmaking plant	64·7	67·2	74·8	76·0	79·0	80·3
Consumption in blast furnaces	2·2	2·1	1·8	1·8	2·0	2·0
Consumption in rolling mills (1)	0·5	0·5	0·5	0·5	0·5	0·5
Total requirements	67·4	69·8	77·1	78·3	81·5	82·8
Circulating scrap in the steel industry	30·8	31·8	30·2	30·2	32·4	32·4
Process scrap from fabricating industries	15·8	15·6	18·1	18·1	19·3	19·3
Capital scrap	19·8	21·3	25·6	25·6	26·6	26·6
Total resources	66·4	68·7	73·9	73·9	78·3	78·3
Requirements not covered by internal resources	1·0	1·1	3·2	4·4	3·2	4·5
Availabilities of pre-reduced ore	(2)	(2)	2·0	2·0	2·0	2·0
Net imports	1·0	1·1	1·2	2·4	1·2	2·5

(1) For rerolling.
(2) Not included in the consumption for 1973 and 1974.

Prospects for 1985

A clearly different approach has been used to formulate the outlook for 1985.

For 1980, an estimation of the consequences of all declared investment in the steel industry for the supply conditions for scrap was made.

For 1985 on the other hand, the objective has been to seek a division by process of production which was compatible with the foreseeable development of availability of scrap and pre-reduced ores.

The estimates have been established on the following basis:

— production of steel: 188 million metric tons under average conditions and 202 million metric tons as the upper limit,

— consumption of steel (rolled products): 137·5 and 144·2 million metric tons respectively,

— the share of continuous casting in the production of steel: 37 %,

— steel scrap rates: the same hypotheses as for the 1980 forecast,

— development of capital scrap: + 2·5 million metric tons in comparison with 1980; this result was obtained with the model used for the forecasts for 1980,

— availability of pre-reduced ores: four million metric tons,

— net imports: 1·0 million metric tons,

— share of open-hearth procedure in total steel production: 3 %,

— specific consumption of scrap on the steelworks: same hypotheses as for the forecasts in 1980.

— scrap consumption in the blast furnaces and rolling mills: 2 million metric tons,

— development of production and of consumption of scrap in the iron foundries: estimated in a special study on the foundries.

The total supply of scrap and pre-reduced ores in 1985, including net imports, calculated according to the above assumptions comes out at 85 million metric tons for the average trend and 89·5 million metric tons for the upper limit, an increase of c. 10 % in comparison with 1980. The division of steel production between the oxygen and electric processes can be calculated starting from this estimate and retaining the assumptions relating to specific consumption and the share of the open-hearth process in total production. In this scenario the optimal structure of production would be as follows:

— open hearth: 3 %,

— electric: 22—23 %

— oxygen: 74—75 %,

The percentage calculated for electric steel in 1985 should be considered as conservative because of the assumptions used in the estimation of the availability of capital scrap. Then again a more rapid decline of the open-hearth steelworks or an accelerated development of the availability of pre-reduced ores could lead subsequently to a growth of the share of electric steelworks in total steel production.

In terms of quantity the forecast supply conditions for 1980 give no cause for concern provided that the structure of steel production by process already mentioned is maintained, and the lower scrap input assumed for the oxygen process is achieved. This, of course, implies a relatively high scrap price at favourable levels of activity in the steel industry. However, if the scrap input should correspond to the higher inputs of the second assumption or even exceed them, such a high deficit would result that given the foreseeable shortage on the world scrap market serious supply difficulties would arise. The steel industry should therefore strive to achieve the scrap inputs named under the first assumption to avoid such difficulties. This implies an increased use of pig-iron in the periods of favourable economic activity. The supply situation with respect to pig iron and scrap in the steel works being different from country to country and region to region, the equilibrium represents a community balance which can be attained, as was the case in 1973 and 1974, even if in certain areas the inputs do not correspond to the average assumptions used in the estimates.

After 1980 a further small increase in the share of electric steelworks may be possible under the aforesaid conditions. However a limited proportion of the steel thereby produced may be utilized for the production of wire rod and sections since the growth in demand for these products is slower than the forecast increase of the production potential for electrical steel. An exception to this could occur in the case of an acceleration of the closure of old plant for the production of the aforesaid products. As we have already indicated a danger exists of an excess of production potential in the year 1980 for these products.

Quality aspects

However, prospects are far from reassuring for works normally using good quality scrap. The expected rate of development for special and alloy steels using better quality materials is in complete contrast to the growing scarcity of this type of scrap. A more intensive recycling of alloy scrap from outside the steel industry appropriately prepared in homogeneous batches would contribute to lessen this divergence. For converter shops which will by then be equipped with continuous casting plant, the need to make up the probable shortage of circulating scrap of their own by selective purchasing on the market would entail lesser difficulties because of the flexibility of the pig-iron/scrap ratio in their charges. An increase in the quantities of pre-reduced ores available could partly offset the harmful effects of the relative reduction in the supply of top quality scrap. In addition, for the production of ordinary steel in electric furnaces the charging of a certain percentage of pre-reduced ore would allow the consumption of lower quality scrap to be increased and thus ease the market situation for good quality scrap.

In recent years the situation on the Community scrap market has in general varied according to the type of scrap considered. There have never been any difficulties in disposing of heavy scrap and process scrap, whereas in times of unfavourable market conditions not all the light capital scrap collected has been sold.

The following comments can be made about the years ahead:

(a) the increase in continuous casting will substantially reduce the share of circulating scrap in the total scrap available. This is by far the largest source of top quality scrap;

(b) a study of steel consumption trends by product between 1960 and 1980 shows that no major change is to be expected in the available qualities of process and capital scrap. The slow increase observed in the past in the share of light capital scrap of lower quality in the latter category is likely to continue.

These factors show that the general structure of the scrap qualities available to the steel industry will change considerably by 1980. The relative increase in light capital scrap is likely to give rise to problems in burden composition. A major effort has already been made by the scrap trade to improve preparation techniques. Mention should be made of the enormous increase in shredding and shearing installations in the Community.

These efforts must be continued both in the interests of the supply of the steel industry and of environmental protection and in combination with attempts to obtain a better geographical distribution of the installations.

At a later stage, the steel industry will also have to adapt to the change in the quality structure of scrap availabilities.

Improved organization and more efficient management of scrap yards and an improvement in the methods of charging light scrap into converters could help to overcome the difficulties resulting from the relative reduction in the availability of heavy scrap.

Iron foundries

A detailed statistical study of the activities and raw materials requirements of iron foundries has been made as part of the General Objectives for Steel, with the cooperation of the trade associations in that sector.

Foundries are an important outlet for certain categories of pig iron. They also purchase large quantities on the scrap market and this must be taken into account in any analysis of the trends on this market.

The foundry sector has provided the Commission with detailed data on:

— production and external trade in castings,

— existing and foreseeable technical equipment,

— existing and foreseeable specific consumption of new pig iron, iron scrap and steel scrap,

— deliveries by sectors (motor, engineering, building and steel industries and other sectors).

These figures covering the period 1965 to 1973 were broken down into grey cast iron, malleable cast iron and spheroidal graphite cast iron.

From the sector studies in the chapter on internal markets for steel, it has been possible to define general weighted indices of activity for the four major sectors using castings which make up 80 to 90 % of the foundry market. These have been set against the foundry deliveries by sector and a forecast of the foundry internal markets for 1980 prepared.

Combining this with assumption on external trade, a forecast of casting production for 1980 has been obtained.

With regard to consumption of purchased raw materials, a retrospective series and a forecast for 1980 has been prepared on the basis of data from the sector and forward estimates of activity made by Commission staff.

The following tables summarize the results of the study which were taken into consideration in the chapter on supplies in the General Objectives.

Consumption of purchased raw materials in Community iron foundries

(million metric tons)

	1973	1980	
		average trend	upper limit
New pig iron	5·3	5·8	6·3
Iron scrap	3·8	4·0	4·3
Steel scrap	4·3	4·5	4·9

Total production of iron castings in the Community

(million metric tons)

1973	1980	
	average trend	upper limit
12·7	13·2	14·3

C — *IRON ORE*

Forecasts of Community consumption

Iron ore requirements depend on pig-iron output, the use of other iron-bearing materials for pig-iron production and the amount of iron ore used in steelmaking plant.

In the original Community countries the use of scrap and some of the recycled materials in the blast furnace burden is continuing to decrease. Consumption of calcined pyrites is also declining sharply. In the United Kingdom, however, relatively large quantities of scrap are still used for pig iron but a reduction is expected in order to improve blast furnace working.

Iron ore consumption per metric ton of pig-iron production is still increasing slightly. While in 1970 859 kg Fe from iron ore (including ore used in steelmaking plants) was utilized per ton of pig-iron, in 1973 the consumption in the Community was 891 kg; it will probably approach 900 kg in the years to come. With the expected trend in pig iron production, this means that 106·4 to 115·9 million metric tons Fe from iron ore will be required in 1980 and 117·1 to 127 in 1985. The relatively small increase is due to the expected reduction in the pig-iron/crude steel ratio.

In both percentage and volume terms the coverage of demand by Community iron ore deposits will continue to fall. French iron ore mine production will remain fairly stable, but in the other regions greater reductions are anticipated due to closure. A critical factor is that in some cases with the switch from domestic ores to imported ores the otherwise necessary investment expenditure for the expansion of capacity for pig-iron production can be saved since the use of the rich imported ores allows blast-furnace capacity to be markedly increased.

Consequently domestic supplies are increasingly confined to the Minette deposits, and even here output is declining substantially in the Luxembourg section.

Maintenance of output in the remaining mining regions, which until now have managed to withstand competition from foreign ore without great difficulty, will depend on price trends on the world iron ore market, on adequate supplies of these ores being available and on general cost trends. Productivity here can only be increased to a limited extent, if at all. The great disadvantages are the lower iron content of these ores and the large amount of energy required to smelt them.

In the Minette region, the favourable conditions in the deposits and the highly developed mining techniques, together with greatly increased productivity mean that the ores can still be economically smelted in works close to the mines. Special tariffs have been granted by the railways to counter actual or potential competition from other forms of transport. However, the disadvantage of long distances can only be offset if other cost factors are particularly favourable.

The boundary line in competition between domestic and imported ores is flexible. A further factor is that mixed burdens of domestic and foreign ores can in some locations lead to lower pig-iron costs than the smelting of low- or high-grade ore alone. Local operating conditions in the works also play a part here. According to the most recent survey, iron ore deposits in Lorraine amount to 1 250 million metric tons calcareous and 720 million metric tons acid ore, but only 300 to 400 million metric tons of the latter can be used for the ore burden with present dressing techniques. It is therefore necessary to step up research on the separation of the acid constituents in certain grades of ore.

The iron content of the ores mined in Lorraine has been increased by exploiting only the richer parts of the deposits. The limit has now been reached if the life of the ore fields is not to be appreciably reduced.

Supplies of domestic ores will also be of great importance in the future from the aspect of security of supply, quite apart from any effects in certain iron smelting districts. The situation on the ore market in recent years and the probable future trends in supplies of foreign ores make it clear that any possible Community source of supply should not lightly be cut back. Because of the high capital expenditure required and the demand for additional quantities of iron ore, it will not be possible to expand mining undertakings abroad to the extent necessary to guarantee an easy iron ore market at all times.

Indigenous iron ore production not only guarantees part of the Community's supplies — it can also play a stabilizing role, tempering to a certain extent excessive price demands for foreign ores; in view of the recent collaboration between iron ore exporting countries fear of such demands is not unfounded.

In the context of its raw materials policy, the Commission will have to consider how the remaining iron mining activities can be safeguarded in the long term.

The following table shows the coverage of the Community's iron ore requirements in the medium term. The substantial reduction predicted in its own supplies is due mainly to the expected pit closures in the United Kingdom and West Germany.

In terms of metric tons iron-in-ore, the percentage of demand met by Community ore will fall from 23·2 % in 1973 to 17·7 to 16·2 % in 1980 and 14·4 to 13·3 % in 1985. There would be some slight improvement if the mines in Eastern France were granted aid enabling them not only to maintain but even somewhat to increase their output.

It is not expected that the iron content of imported ore will increase above the qualities currently being supplied. Only when special pellet qualities or pre-reduced ores become available in greater quantities on the market at a later date is the iron content of the material charged in the iron and steel industry likely to be increased.

Increase in and supply of Community iron-ore requirements

(million metric tons)

	1965	1970	1972	1973	1974	Forecast for average to good market conditions for crude steel production 1980	1985
Crude steel output	113·9	138	139·1	150·1	155·6	170 —183	188 —202
Pig-iron output	87·0	98·4	96·8	106·9	112·1	118·4—129·0	130·3—141·2
Iron-ore consumption in metric tons Fe	67·8	84·5	84·4	95·3	100·7	106·4—115·9	117·1—127·0
Community ore in metric tons Fe	26·1	24·2	23·1	22·1	21·1	18·8	16·9
Ore imported from non-member countries in metric tons Fe	41·7	60·7	61·3	73·2	79.6	87·6— 97·1	100·2—110·1

Iron ore requirements in metric tons of ore

(million metric tons)

	1965	1970	1972	1973	1974	Forecast for average to good market trends for crude steel production 1980	1985
Community ore	89·8	80·1	75·2	71·1	68·1	58·8	52·7
Imported ore	69·6	98·6	100·1	118·8	129·6	141·2—156·6	161·6—177·6

The estimated requirement for foreign ores is 141 to 157 million metric tons in 1980, which means that the Community will then have to import between 22 and 38 million metric tons more than in 1973. By 1985 this will have risen to 43 to 59 million metric tons.

Community ore imports and probable trends on the world market

For its iron ore supplies from non-member countries the Community is at present largely dependent on the international market. However, there are indications that the iron-smelting industry will change its supply policy in order to secure increasing quantities through medium- and long-term contracts.

Up to about 1980 the proportion of demand met from holdings in foreign mining companies will be 16 to 18 % but thereafter, despite the increasing iron ore requirements, it will probably rise to around 25 % with the expected completion of new and economically viable mining projects, chiefly in Africa and Brazil. The political investment risk is likely to be lessened in future by the efforts to achieve a greater merging of interests between the mining companies and developing countries. Here the links between the Community and the associated developing countries should be of help in facilitating the granting of credit or the establishment of commercial agreements.

The traditional supplies from the North European countries (Sweden and Norway) to the Western European smelting industry can be considered a further security factor, despite certain limitations. The high-phosphorus Swedish ores in particular have some influence on trends in the production of high-phosphorus pig-iron in iron works mainly geared to Community ores. However, one basic condition is that the ore prices allow crude steel costs to remain fully competitive in comparison with the cheaper working of low-phosphorus ores. Only if the necessary guarantees in the mutual interests of ore suppliers and users can be secured will further large quantities of high-phosphorus ores be imported from Sweden.

Although iron works geared solely to iron-ore imports are likely to reduce their consumption of these ores, this will probably be offset by purchases by new Community customers.

In the past ore purchases were usually only arranged to cover one year's needs but henceforth medium- and long-term supply contracts will increasingly be concluded. Alongside contracts with financially independent iron-ore producers, which have the advantage for both sides of guaranteeing absolute quantities, there will also be contracts with mines to be developed in which financial holdings or investment-type loans of varying amounts will form an essential feature of the contract. Forward-looking supply arrangements of this type will be limited in the first instance to a few major iron-ore users in the Community, but a broadening of this base should be striven for.

For the Community as a whole, however, security of supply will still be far from complete in the future, despite the steps taken by the iron and steel industry to secure its supplies by investing in overseas mining undertakings and by concluding contracts covering several years. This will be discussed at length later in connection with the market equilibrium.

The sharp worldwide increase in crude steel output over the past 10 years has led to a greatly increased demand for iron ore. Because of the length of time needed to open up new iron ore deposits and to expand capacity in the few mining undertakings with surplus resources only an approximate balance emerged on the world market between ore supply and demand.

Depending on the market conditions in the iron and steel industry, there have been since 1970 various bottlenecks in the supply of the ore qualities required and this has been reflected in price trends. After the sharp fall in prices in the Sixties resulting in part from the large ore surplus and cost-saving techniques adopted by large mining companies overseas, and the reduction of freight rates due to the introduction of large ore-carriers, ore prices have on average risen by 65 % to 80 % between 1969 and 1975, with increases of as much as 100 % for some grades.

Apart from market conditions when supply is tight, the main factors pushing up ore prices have been above all the cost increases in mining undertakings and to a lesser extent marine freight rates — since these are less subject to the fluctuations occurring on the general marine freight market because of the use of large vessels which are tied to ore carrying. There is only a limited prospect today of achieving cost reductions by technical improvements or refinements in organization in the mining of the ore or in the infrastructure of the mining industry.

The finance required for new projects to increase capacity, to construct ore enrichment-plants (for beneficiation, pelletizing and direct reduction) and to open up virgin iron-ore deposits have more than doubled, and in part tripled, in comparison with the years 1958 to 1962 when the first mammoth undertakings were being developed. Acceptable levels of capital costs at around 50 % of total costs per metric ton iron ore free on board can generally only be obtained in new mining undertakings having outputs of at least 10 million metric tons per annum.

The three largest steel producers in the western world, the Community, the US and Japan, together imported 298 million metric tons of iron ore in 1973; this amounted to 93 % of the total deliveries on the world market. The demand for iron ore on the world market will probably be 360 to 380 million metric tons in 1980 and 400 to 438 million metric tons in 1985. In calculating these figures allowance was made for increased self-sufficiency in the US as a result of the extension of pelletizing capacities and for a reduced Community supply from its own iron mines.

The iron and steel industries of Western European countries that are not members of the Community are being greatly expanded. According to steelworks projects that are planned or under way, growth rates of over 7 % are likely up to 1985. The smelting of domestic ores with a lower iron content and in some cases undesirable impurities is declining because for economic reasons the prime costs of iron products must increasingly be adapted to those of the major pig-iron and crude steel producers. Imports of iron ore will triple between 1973 and 1985.

World crude steel output

(million metric tons)

Industrialized area or region	1965	1970	1972	1973	1974 (1)	Forecast for average and good market trends			
						1980		1985	
						average	good	average	good
European Community	113·9	138·0	139·1	150·1	155·7				
West European countries (2)	15·7	24·0	26·9	29·1	30·9				
USSR	91·0	115·9	125·6	131·5	135·3				
East European State-trading	28·5	39·7	44·6	46·9	48·7				
North America	131·5	133·3	135·4	150·9	148·5				
Latin America	8·3	13·2	15·6	16·7	17·8				
Middle East and African countries (3)	3·5	5·7	6·3	7·0	7·2				
Asia (excluding Japan) (4)	8·1	9·5	10·7	11·6	13·1				
Japan	41·2	93·3	96·9	119·3	117·1				
Australia and Oceania	5·6	7·1	7·0	7·9	7·9				
World excluding China	447·3	579·7	608·1	670·5					
China (5)	12 ?	18 ?	23 ?	24 ?					
World total approximately	459	598	631	695		892	935	1 040	1 100

Source: Statistical Office of the European Communities, statistics of Community countries, ECE Statistics, Geneva, special statistics, own estimates.
(1) Provisional figures.
(2) Including Yugoslavia and Turkey.
(3) Including South Africa.
(4) Including India and North Korea.
(5) Rough estimate.

Any prediction of future iron ore purchases on the world market by East European State-trading countries is extremely unreliable. Their targets for future crude steel capacities are more or less known. The growth rates for crude steel output will lie between 4·5 % and 5 % in the medium term, and iron ore requirements will increase by almost 50 % by 1985. The output of their own iron mines is unlikely to be increased in view of the generally poor ore quality, and it may even decline. The USSR has up to now supplied 85 % to 90 % of the necessary ore imports but the prospects of any great increase in supplies from the Krivoi-Rog mines, the only possible presently known source of expansion, appear relatively limited. Imports by State-trading countries from the world market will therefore increase in the future. There are already indications of this in the conclusion of new supply contracts.

With the efforts being made or likely to be made to extend or construct steelmaking capacities in the countries undergoing or about to undergo industrial development that have no or insufficient iron ore resources of their own, more and more iron ore will be needed on the world market in the future, especially as the local scrap availabilities in those countries, with a few exceptions, would be sufficient at most for a minimal crude steel output and there is little prospect of large scrap imports in the future. This applies in particular to the Arab countries, and to Iran and some other Asian countries.

According to this table, the import requirements of countries obtaining their supplies on the world ore market will be 400 to 427 million metric tons in the year 1980, after allowing for trends in their own mining industry and including smaller users and new pig-iron producers, together with producers of prereduced ore. By 1985 468 to 518 million metric tons of iron ore will be needed. Total world consumption of iron ore will rise between 1974 and 1985 by some 360 million metric tons to about 1 150 million metric tons.

The above figures are based on the crude steel output estimated in the world crude steel table. In addition to more or less definite future extensions of capacity, this table includes realistic-sounding ironworks projects and production targets in the individual countries. Up to 1980 crude steel production potential is fairly certain. The probable output depends solely on cyclical trends in world

Forecast of world iron ore requirements and the requirements of the pig-iron and crude-steel producing countries dependent on iron ore imports on the world market

(excluding China)

(million metric tons)

	World iron-ore output excluding China (²)			Forecast of total iron-ore requirements with average to good market trends for world pig-iron and crude-steel production				Forecast of iron-ore requirements on the world market with average to good market trends for world pig-iron and crude-steel production (¹)			
	1970	1972	1973	1980		1985		1980		1985	
World excluding China	734	720	790	965	1 020	1 080	1 165	400	427	468	518
Safety factor for loss of output and free choice of ore 10 %								+ 40	+ 43	+ 47	+ 52
Necessary supply capacity on free international market								440	470	515	570

(¹) Excluding deliveries by USSR to East European State-trading countries.
(²) The statistics differ according to source.

steel consumption. Between 1980 and 1985, however, some further projects for iron and steelworks, which are not as yet envisaged, may in fact be realized.

The supply capacity of the world iron-ore market should be somewhat higher than the consumption figures in order to guarantee a choice of iron ores and a safety margin to allow for production losses in the mines and delays in the sea transport of the ore. In general, then, the world ore market should be capable of supplying about 10 % more than the actual demand. This means that the capacity of the international iron-ore market in 1980 should be at least 440 million metric tons, but should be geared to a figure of 470 million metric tons. By 1985 capacity should be extended to around 570 million metric tons.

From the geological aspect, the iron ore from known deposits considered as economically workable by current standards will be sufficient for a very long time to come. The production potential of the mines supplying the world market depends on investment activity and the carrying out of the necessary additional measures to expand capacity.

The current capacities of the mines geared to ore exports are in most cases fully utilized as a result of the great increase in demand over the past five years. However, a number of larger mines are planning to increase output by extending their plant. The additional quantities that will then be put on the market will be sufficient to cover demand only in the very short term. New projects must be put in hand; other projects are already so far advanced that it is now possible to predict when the ore will become available.

The main sources of supply for the Community are the countries around the Atlantic and in Northern Europe. Australia offers further prospects that are more than marginal. The US and Japan also obtain supplies from the Atlantic countries and so increasingly do Western (non-Community) and Eastern European countries. In the foreseeable future the Arab countries will also become customers. It is therefore particularly important to develop iron-ore mining in this western region and to consolidate its supply relations with the Community.

In the efforts to secure supplies it must be remembered that some industrialized countries producing raw materials are using considerable quantities of iron ore as they enlarge their steel industries. As they build up their pig-iron and semis capacities for export, they also withdraw from the market quantities of iron ore that were earlier available to iron and steel industries dependent on ore imports. The buying of pellets by the Arab countries, whose crude-steel production is based on direct reduction, will also have repercussions. As these purchases are frequently offset by oil deliveries, in the form of firm supply arrangements, it is likely that in the medium term large quantities of high-grade ore will cease to be available to the Community iron and steel industry.

The mining of ore for export from large deposits that will last for well over the normal amortization period of 25 years for iron ore mines, even if very large quantities are extracted, is limited to a few areas: Northern Canada, Brazil (Quadrilatero Ferrifero and Carrajas region), South Africa (Sishen region), Western Australia, Northern Sweden (Kiruna region). Some of the smaller mines will be worked out during the period under review. In some cases activities can be transferred to other deposits within a reasonable distance, but the necessary investment is of almost the same order as the high capital outlay required for completely new projects.

Geographically, Japan is best situated to obtain supplies from the Pacific countries. The major supplier is Australia from which about 50 % of Japan's total iron ore requirements come. Australia's current and future production potential is so enormous that it can easily maintain and possibly even increase this share. In the interests of both countries, however, there are limits to this mutual dependence which will not go beyond certain orders of magnitude in iron ore production.

In India, another of Japan's major suppliers, there are limits to the increase in iron ore output despite the existence of extensive reserves in several regions. This special situation results from the level of economic development, and the low capital resources in the country.

The modernization of iron-ore mining in general and the extension of the necessary infrastructure are being delayed. The desired production targets are scarcely attainable within the planned time scale.

Conditions in the iron-ore deposits of Chile and Peru limit their output to an approximately constant level. Other countries around the Pacific supply only marginal quantities.

World trade — Forecasts for 1980 and 1985

(million metric tons)

	Average to good cyclical trends in iron ore requirements	
	1980	1985
Basis:		
World crude steel output	892—935	1 040—1 100
World iron-ore market:		
Import requirements of the three major consumers (European Community, Japan, US)	360—380	400— 438
Smaller European industrialized countries	25— 29	36— 42
Non-European countries with budding steel industry	15— 18	32— 38
Total import requirements	400—427	468— 518
Market capacity required for free choice of ore and security against supply failures + 10 %	440—470	515— 570
Available export capacity (excluding new projects not yet certain)	430—445	445— 460
Possible additional export capacities (including planned projects that appear realistic)	20— 25	90— 100

In view of what has been said above about the supply potential of the Pacific countries, some of which (although initially only to a minor extent) will be taken up by the newly developed iron and steelworks in the Asian countries, it is obvious that Japan will continue to purchase large quantities of iron ore from the region supplying the Western European steelworks.

The forecast of the future export potential of overseas iron-ore mines is based on proven and probable mining capacities and in certain supplier countries on their own iron-ore requirements for a steel industry in process of development. In addition to existing capacities and planned extensions of existing undertakings, reliable projects with a fixed timetable and easily implemented plans to increase output with a low capital outlay were included in the forecasts. By 1980 additional export potential of around 20 to 25 million metric tons could be created by means of suitable measures on the part of iron ore users.

After 1980 new mines will probably start operations or reach a state of full productive readiness. It is also probable that some large-scale projects will be undertaken; this is indicated by the formation of exploration companies, but the financing is still unsettled. In view of the numerous iron-ore deposits that can be regarded as workable and have ore reserves capable of satisfying the steelworks' requirements, possibly after beneficiation, it is to be expected that when the present preliminary surveys are completed further mining ventures will reach the project stage within the next five years. The resultant realistic figures for additional iron ore production potential for export by 1985 is 90 to 100 million metric tons.

The share accounted for by the developing countries in the export capacities given in the table is about 45 %, but a large proportion of this is accounted for by Brazil and Venezuela. Excluding these two countries, the level of industrialization and economic standard of which virtually excludes them from the group of developing countries, the latter will in 1980 account for about 22 % of the iron ore supplies on the world market.

Assuming average growth of world crude steel output, the expected ore availabilities will allow a limited choice of ore up to 1980. However, if economic conditions are good, ore supply and demand will more or less balance. The market conditions prevailing since 1970 with temporary shortages of certain types of ore, including pellets, will therefore continue in the near future. The Community steel industry must take precautions to secure its iron ore supplies in sufficient quantities on the same conditions as other iron ore purchasers on the world market by long-term commitments and the conclusion of far-sighted contracts. This applies in particular to blast furnaces which are still largely obtaining the iron ores they need by means of short-term contracts on an annual basis, despite the analysable market trends. The buyers' market disappeared years ago when the ore surplus was run down and will probably never make its reappearance. Speculation in the hope of taking advantage of lasting lower prices is therefore no longer justifiable.

After 1980, even assuming average market conditions for world steel output, there could be shortages of iron ore, if the realization of new projects is delayed. The Community iron and steel industry can to some extent guard against this by taking early decisions on mining projects and obtaining financial holdings in or granting loans for the formation of mining companies, or by declarations of intent followed by commitments to purchase large quantities of ore from newly developed deposits.

There are particular advantages in this course in Brazil and some of the African countries, such as Gabon, Liberia and the Ivory Coast.

In view of the enormous capital required for new mining ventures, combined with the necessary housing, transport and port facilities, even major steel undertakings in the Community have financial difficulties in finding the money necessary for their holdings. Financing aid is required. The ECSC Treaty and Community measures under the raw materials policy can assist here provided the project is in the general interest of the Community.

In comparison with the United States and Japan, the Community is poorly placed for its iron-ore supplies. The United States can, if necessary, supply itself from the North American region together with Canada. The large production surpluses in its overseas mines provide an additional security factor. Japan has supply advantages in the vast area around the Pacific, and its supplies of iron ore are almost totally secured by long-term contracts, in some cases combined with the contribution of capital or loans. So far only minor difficulties have arisen, as a result of purchasing commitments when steel demand has been overestimated and consequently ore consumption has been lower than expected.

The beginning of collaboration between iron ore exporting countries must be followed carefully. It may disturb the world iron ore market and consequently may invite special measures from the affected industrialized countries.

The initiative of the iron-ore user towards security of their supplies results from the current outlook on future market developments. This applies not only to quantities but also to qualities, expecially of pellets. In the future, however, iron ore will not be the only raw material available on the market for the iron and steel industry. In the next decade it will become possible to purchase pre-reduced ores, and pig-iron and semis will increasingly be available on the market for further processing in industrialized countries. Some countries with raw material reserves and oil-producing countries with very cheap energy offer the best economic conditions for this.

D — *SPONGE IRON*

Introduction

The significant feature of the direct reduction of iron ores is that it does not require the use of scarce and expensive metallurgical quality coke and can be carried out with almost any other reducing agent and any other form of energy. On the other hand, it has the disadvantage that the iron is only separated from the gangue in the steel plant, but this is partly offset by the availability of a number of iron ore types with a small proportion of gangue that can economically be separated at the steelmaking stage. A further reason for the great interest being shown in sponge iron is the relative decline in the supply of high quality scrap as a result of the increase in continuous casting.

The High Authority (and later the Commission) was well aware of the potential importance of direct reduction right from the start. Consequently at a very early stage it allotted considerable funds for research and development in the field of direct reduction as part of its responsibilities for research under Article 55 of the ECSC Treaty. The projects promoted included the Krupp sponge iron process, the PUROFER process and more recently research into the use of brown coal in the SL/RN process. This activity is being continued under existing research contracts.

The Commission also periodically collects information on the present status of direct reduction. The fourth version of a study on direct reduction will be published simultaneously with the General Objectives for Steel 1980 to 1985, and therefore there is no need to go into great detail in this section of the General Objectives.

The various direct reduction processes

There are more than 60 processes for the direct reduction of iron ores, some only at the laboratory stage or being investigated in small or semi-industrial plant, but so far only six or seven of them have been developed to the industrial stage. Currently production plant of various types with a total capacity of around four million metric tons per annum is in service in a number of different countries; many times this capacity is under construction or at the planning stage. The processes already in use can basically be divided into two categories according to the type of reducing agent used, solid or gaseous.

The following processes using gaseous reducing agents, especially natural gas and coke oven gas, are now available: the MIDREX, PUROFER and ARMCO methods in the shaft furnace, the HYL method using a retort (and with some reservations the HIB and FIOR fluidized-bed methods).

The SL/RN and KRUPP sponge iron methods using long rotary kilns operate with solid fuels.

For all these methods except the fluidized bed ones, lump ores or preferably pellets are the raw material required. Fine ores can be used directly for the fluidized-bed methods but the technological problems involved in maintaining the fluidized bed in large scale plant are not yet completely solved. However, research work is continuing. Other processes involve the production of liquid iron, but so far the problems of heat transfer and the refractory cladding of the reaction vessel have not been solved for this 'melting-reduction' process. Here too research is being continued.

In all the methods using gaseous reducing agents, the agent must first be converted into a mixture of carbon monoxide and hydrogen or into pure hydrogen. This conversion process is simplified if the primary energy is already in gaseous form, such as natural gas or coke oven gas.

In principle, however, gasification of solid and liquid fuels is also possible but calls for more costly plant. Consequently it appears probable that in future direct reduction will be more or less limited to the use of natural gas or of solid fuels in plant designed for that purpose.

An advantage of the reduction methods using gases is that they can be self-contained — in other words the gases only partially utilized in the reduction process can be recycled after suitable cleaning. There is thus no need to find another user for surplus waste heat. In all these techniques energy consumption only a few years after their introduction is already extremely low at about three Gcal per metric ton.

For methods with solid reducing agents, a wide variety of fuels can be used ranging from brown coal through high-volatility hard coal to the anthracites and including high-ash coals. Gross energy consumption in these processes is higher than in those using gaseous reducing agents and again depends on the quality of the fuels used.

Most of the heat from the waste gases can be recuperated in the way of waste heat steam but this presupposes that there is another user for this form of energy.

If the waste heat can be utilized, the net energy consumption in these processes is not very different from that with gaseous fuels. Whether or not it is necessary to use the waste heat also depends on the availability and price of the solid fuels uses. At European prices, it is hardly conceivable that the process could operate economically without waste heat utilization.

Iron ores for direct reduction

If sponge iron is made from high-grade ores and has a sufficiently low residual oxygen content it is at least comparable to the best scrap qualities and can be used wherever scrap is normally used and in particular where quality is of special importance. However, its value declines exceptionally quickly as the content of gangue or other impurities increases. A significant factor in assessing the importance of sponge iron is the availability of suitable iron ores. World iron ore output and existing mining projects were therefore examined to see whether the ores were suitable for direct reduction.

High-grade ores containing more than 60 % Fe were divided into three categories:

The first category comprises ores with a content of acid gangue (silica and alumina) not exceeding 5 % of the iron content and a phosphorus content below 0·05 %; this means that these ores should normally have an iron content between 67 % and 69 % and are particularly suitable for direct reduction.

World output of iron ore of this quality was about 65 million metric tons in 1973. About 22 million metric tons of this were sold in the form of lump ore, about 16 million metric tons as pellets and the rest as fines.

For the same ore quality there are mining projects to be implemented by 1985 totalling an annual capacity of from 100 to 150 million metric tons, depending on the source consulted.

Reserves of ores of this quality are very large, certainly well over 20 thousand million metric tons. However, they are concentrated in only a few regions of the world. Brazil has by far the largest quantity, followed by South Africa and Canada. Small deposits are to be found in other places.

The second category of high-grade ores has an acid gangue content of 5 % to 9 % of the iron content and a phosphorus content no higher than 0·05 %. The iron content is generally between 64 % and 67 %.

In 1973 138 million metric tons of this ore quality were mined. New projects cover an annual capacity of 135 to 175 million metric tons. Ores in this category are still suitable for direct reduction but costs in the steelmaking plant are substantially increased.

The third category embraces ores having acid constituents exceeding 9 % of the iron content or more than 0·05 % phosphorus. These ores have an iron content of between 62 % and 64 %. Over 300 million metric tons of this quality were mined in 1973. The use of ores of this quality for direct reduction in the Community is out of the question on economic grounds.

All these figures indicate that in principle there is sufficient ore, even of top quality, for direct reduction but, as the chapter on iron ore shows, the output given above is entirely taken up for the production of pig iron in blast furnaces and even the future output of the serious mining projects is already committed.

As direct reduction increases the share of the market, it must also be expected to have an impact on ore prices, with the degree of beneficiation playing an important part.

In this context, special attention should also be given to the question of pelletizing capacities. The construction of additional pelletizing installations to meet the special requirements of direct reduction should therefore be rapidly promoted.

Availability of energy for direct reduction

Total energy consumption in direct reduction processes, after conversion of the energy needed to smelt the sponge iron into primary energy, is not very different from energy consumption in the conventional blast furnace/oxygen steel plant process (it is at present slightly higher with a cold charge and lower with a hot charge). The question of the use of direct reduction is therefore in the final analysis a question of the availability and relative prices of various sources of energy. Natural gas is particularly suitable for direct reduction. However, the largest deposits are mainly concentrated in the Gulf states, North Africa and Venezuela. With the exception of Venezuela, these deposits are not combined with suitable ore deposits so the ore has to be imported.

In Europe there are also large quantities of natural gas available, either from imports or from European sources. On the other hand, the demand structure shows that natural gas is also a very advantageous form of energy for other branches of industry and for domestic use. It is therefore unlikely that there will be substantial quantities of natural gas available on favourable terms for direct reduction.

There are adequate supplies of solid fuels in Europe. With the exception of brown coal, however, their prime costs are so high that there is very little incentive to use them for direct reduction.

Brown coal is used mainly for the generation of electricity. Until sufficient nuclear power stations are available, there is unlikely to be a large supply of brown coal for direct reduction. Ways of increasing the supply of brown coal as quickly as possible should be sought.

Outside Europe solid fuels are available at low cost in South Africa, Australia and North America in particular. The production of sponge iron could gain ground in South Africa because of the simultaneous availability of suitable ores.

Economic use of sponge iron

As regards its use for steelmaking, sponge iron is comparable to scrap. In origin and cost structure, however, it is more comparable to pig iron.

The proportion of fixed costs in the scrap price is comparatively low and therefore scrap prices have always been able to adapt very well to the economic conditions of the moment; in times of poor market conditions steel companies using scrap have been able through lower scrap costs to offset much more of the fall in the prices of their steel products than could steel companies using ore.

If the industry using scrap were to convert to sponge iron it would lose much of this flexibility as direct reduction plants, like blast furnaces, operate with a high proportion of fixed costs, raw material and energy supplies have to be secured by long-term contracts or holdings and in principle such plant cannot be shut down and started up again as required.

These factors are likely to prevent a free sponge iron market from growing up alongside the scrap market. Potential purchasers of sponge iron must assume that their sponge iron supplies can only be secured by long-term supply contracts or holdings in direct reduction installations.

It may also be assumed that even if comparatively cheap energy is used there will be little difference in the prime costs for crude steel based on sponge iron and that based on pig iron as almost all the other cost factors are similar.

Because of the growing scarcity of scrap and the constant decline in scrap quality, however, sponge iron should be taken into consideration by special steel producers in particular when they consider their future supply plans.

To avoid losing cyclical flexibility, sponge iron should be used only as a minor component of the burden. Direct reduction plants, although small in comparison to blast furnaces, generally have too large a capacity for those steel companies, mostly small ones, that operate with scrap and therefore it would be advisable for direct reduction plants to be constructed and operated jointly by several steel companies so as to spread the cost risk when market conditions are poor and ensure a reliable basic supply of good quality when market conditions are good.

Location of direct reduction plant

As for the steel industry in general, locations where energy and iron ores are both available would be ideal for the production of sponge iron. A glance at the geographical distribution of raw materials shows that this combination can be found only in very few cases. In those regions there is a firm determination not to stop at the production of sponge iron but to go on to the manufacture of finished steel products, which rules them out for the Community as a source of supply.

The remaining options are to produce sponge iron close to energy sources, close to ore sources or in the vicinity of users.

Obviously countries having one of these two sources will produce for their own needs in the vicinity of that source. This is true of all the extension plans in the Gulf States and in North Africa, and also in ore-producing countries such as Brazil. None of these countries has so far indicated that it intends to produce sponge iron for the world market in addition to its own needs.

Apart from having one raw material conveniently available, however, there are a number of reasons militating against such locations as a central supply base for sponge iron. Regions having cheap energy have to bring in oxide ore over long distances and cannot always do so in optimum-sized ore carriers; what is more, if the ore is imported in lump ore or pellet form, profitability is adversely affected by the proportion of fines, for which there are very limited outlets because of the relatively small quantities involved. It must also be remembered that, because of the large number of users and the generally small capacity of reduction plants, sponge iron can only be carried in comparatively small vessels and this increases transport costs. In addition transportation of the sponge iron still presents technological problems. In many of these countries there are also difficulties in obtaining ancillary materials such as water, port facilities are inadequate and labour is a problem; all these drawbacks can more than outweigh the original advantages of the site.

It should in any case be more advantageous to erect direct reduction plant in the vicinity of deposits although a number of the above drawbacks are encountered there too.

Consequently there are a number of factors in favour of the erection of direct reduction plants in the vicinity of users, despite the higher energy and ore prices. For example, there are no split freights up to production of the sponge iron, there is greater flexibility as regards raw materials and distribution is easier.

Even though in general the erection of direct reduction plants entirely devoted to supplying steelworks in Europe will definitely not be profitable, the construction of such plants within the Community is to some extent justified.

Future trends in sponge iron production

In the world there are at present sponge iron capacities totalling a nominal four million metric tons in service, 0·4 million metric tons being in the Community. Judging from plant under construction or for which firm orders have been placed, total capacity by 1980 should be about 20 million metric tons. Studies and calculations are now in progress on the construction of further capacities of around 30 million metric tons.

As far as the capacity of 20 million metric tons mentioned above is concerned, it is clear that plants outside the Community are intended solely to supply the respective national steel industries. This does not completely rule out the possibility of certain quantities of sponge iron reaching the international market on a temporary basis as in some cases the steelmaking plant to be associated with the direct reduction installations will not enter into service until after sponge iron production has started. It is therefore to be expected that in 1980 about two million metric tons of sponge iron will be available on the market.

Within the Community, apart from the existing capacity of 0·4 million metric tons, there has only been one official announcement of the construction of an additional plant of about the same capacity.

However, further projects which would provide a total capacity of four million metric tons are under serious consideration. Of this capacity of four million metric tons, half could be in service by 1980. A further two million metric tons should be available by 1985.

The capacity of two million metric tons would correspond to about 5 % of the scrap requirements of electric melting shops. Although this is not much, it would greatly help to cover the expected scrap deficit, would improve the position as regards high-quality scrap and would not be crucial for general profitability. However, it would be absolutely essential to ensure supplies of suitable iron ores.

The most important factor about sponge iron is not so much its influence on the Community's supply of raw materials as the fact that most of the planned production and processing will take place in countries which have up to now been good customers for steel produced in the Community but might well cease to be in the future.

E — *MANGANESE*

With the exception of indigenous iron ores having a low manganese content, the Community iron and steel industry is, like the other industrial sectors using manganese, entirely dependent upon imports of manganese ore and fairly large quantities of manganese alloys from non-member countries. The mining of manganese and low-grade iron-manganese ores in the Community, which has never been of great significance anywhere but in Italy, will gradually cease in the years ahead both for economic reasons and because the deposits are worked out.

About 90 % to 92 % of manganese ore imports go either directly or to a minor extent in the form of intermediate materials produced by electrometallurgy to the iron and steel industry. Manganese ore is used in the production of ordinary grades of pig iron and of ferromanganese, spiegeleisen and silicomanganese. The last three products are used in steelmaking as deoxidizers and for the alloying of manganese steels.

The consumption of manganese by other industries has little effect on the supply of manganese ores for the iron and steel industry, as the other industries generally require special manganese ore grades (1).

(1) Battery grade, chemical grade.

Since some iron ores themselves contain small amounts of manganese and scrap and slag containing manganese ore recovered after the steelmaking process, the demand for manganese obtained from ore for the production of ordinary grades of pig-iron is largely confined to steelmaking and foundry pig, especially low-phosphorus cast iron.

The manganese content in ordinary grades of pig-iron (2) is currently 0·6 % to 0·8 %, equivalent to 6 to 8 kg per metric ton pig iron. Taking a Community average, 2·5 to 3 kg of this is supplied by manganese ores. A slight decline in this specific consumption is to be expected as efforts are being made to reduce somewhat the manganese content in pig iron.

In the Community about 22 % of the manganese ores processed by the iron and steel industry is used for ordinary pig iron (3).

As a general rule the cheaper iron ores with contents of 30 to 40 % Mn are used for this purpose. However, these ores should have the lowest possible gangue content. The preferred lump ore grades will in future no longer be available in sufficient quantities because of the worldwide increase in manganese demand and consequently a higher proportion of fine ore will have to be accepted.

The major part of the imported manganese ores is used for the production of ferromanganese, especially high-carbon ferromanganese. In 1973 blast-furnace ferromanganese (> 2 % C) production in the Community was 1 066 million metric tons while steelworks consumption totalled 0·976 million metric tons. Some 167 000 metric tons were exported to non-member countries. Because of these exports and the additional, if small, requirements of other users, including independent iron foundries, imports of 144 000 metric tons were required in 1973. As the return of screened fines prior to the use of ferromanganese in the steel plant amounted to about 8 to 10 %, the quantities of ferromanganese actually required are larger than the consumption shown in the statistics.

In view of the traditional trade relations which Community ferromanganese producers have with

(2) Excluding high-carbon ferromanganese, spiegeleisen and special pig-iron.

(3) Total consumption in 1973 2·849 million metric tons, consumption for ordinary pig iron 0·66 million metric tons.

non-member countries, it may be assumed that the export of high-carbon ferromanganese will continue in the future at its present level and may even increase.

The main exporter of the Community countries is France, which exports two-thirds of its production of ferromanganese in addition to meeting its own requirements (1973: 352 000 metric tons). Most of its exports go to other Community countries, accounting for about 20 % of total ferromanganese requirements in the iron and steel industry. It is planned to increase capacity by 100 000 metric tons to 650 000 metric tons in the next few years.

The Federal Republic of Germany and Belgium, also fairly large ferromanganese producers, only cover part of their own requirements; they also export to other Community countries and to non-member countries and are consequently net importers. Under present conditions, no expansion of production is to be expected in the Federal Republic of Germany and any additional requirements will have to be met by imports. No great improvement in self-sufficiency is to be expected in Belgium either.

The United Kingdom can supply 75 to 80 % of the high-carbon ferromanganese it needs. It too will have to increase its imports.

In Italy 40 to 50 % of ferromanganese requirements are now imported but efforts are being made to increase production.

The iron and steel industries in Luxembourg and the Netherlands should continue to adapt to market conditions and purchase varying quantities of ferromanganese from the Community and from non-member countries.

The metallurgical manganese ores used for ferromanganese production should contain as little phosphorus as possible and be substantially free from harmful constituents. These requirements cannot be met by all manganese deposits.

Consequently there are supply bottlenecks which, because of the small number of large suppliers, may have an inhibiting effect on any further increase in ferromanganese production in the Community.

In the past the consumption of high-carbon ferromanganese in steel plant ran more or less parallel to crude steel output, but in recent years the increase in oxygen steelmaking has reduced the growth rate. At present specific consumption in Community countries, excluding Italy, averages 5·0 to 5·2 kg manganese per metric ton steel. The figure for Italy is very different because the special structure of its steelmaking means that it uses far less ferromanganese and far more silicomanganese which it produces itself. In the United Kingdom the proportion of ferromanganese charged is slightly higher.

Specific consumption of high-carbon ferromanganese will tend to remain constant. The lower consumption for oxygen steel [1] and the decline in basic Bessemer steel [1] will be offset by increasing consumption for electric steel. Shifts in the consumption of manganese addition agents will have little influence. It is true that the increase in steels with a very low carbon content will have some impact. Because of the oxidation of the iron, their carbon content cannot be too drastically reduced during refining but on the other hand the specified carbon analysis must be obtained so low-carbon affiné or suraffiné ferromanganese is added instead of the high-carbon grade. This is also true to some extent of a few special steels with a specified carbon content. On the other hand, production of higher quality steels with a normal carbon content, especially steels with improved weldability, is increasing substantially. Here the use of high-carbon ferromanganese is increasing.

The specific consumption of affiné and suraffiné ferromanganese [2] is 0·6 to 0·9 kg manganese per metric ton steel — except in Belgium where consumption is much lower. About one-third of the steelworks' total requirements has to be imported.

The consumption of silicomanganese together with small quantities of silicomanganese aluminium and other special addition agents used as deoxidizers remains relatively constant. The quantities charged vary greatly depending on the steelmaking technique, the deoxidation and killing methods used and the steel products to be made [3]; specific consumption in the steel industry averages 0·7 to 8·8 kg/t steel.

In 1973, 194 100 metric tons were used while a total of 58 200 metric tons was produced in France, Italy and Belgium. About two-thirds of the total imports of 142 100 metric tons came from Norway and 10 % from Eastern European countries. The immediate aim for silicomanganese production in the Community is to extend capacity to about 85 000

(1) Specific consumption of ferromanganese in the Community is 4 to 5 kg Mn/t for oxygen steel and 5·8 to 6·9 kg Mn/t for basic Bessemer steel.

(2) Consumption in the steel industry is about 80 % of total consumption.

(3) In 1973 specific silicomanganese consumption was between 0·33 and 1·6 kg Mn per metric ton steel, varying from one country to another.

metric tons. Considering future market prospects for supplies from non-member countries and the current energy problems, a Community capacity of 100 000 metric tons may be taken as the upper limit for profitable production in the future.

Further trends in silicomanganese consumption will be determined both by a slight reduction in direct charging to steel plant in some countries and by an increase in the demand for affiné and suraffiné ferromanganese, production of which is increasing. Consequently in the medium term total consumption in metric tons may be expected to run more or less parallel to steel output.

Spiegeleisen is now used only here and there in the basic Bessemer process for the production of certain hard steels, especially rails, and will probably be given up altogether. The current quantities are negligible in comparison to total manganese consumption in the steel industry and can be ignored in a review of future total manganese requirements.

The total specific consumption of new manganese addition agents, i.e. excluding scrap and other manganese-containing materials, for steel production in the Community (the United Kingdom excepted) lies between 6 and 6·4 kg Mn per metric ton steel. In general more manganese is used in the United Kingdom in all steelmaking methods, including the oxygen process; specific consumption of new manganese is 7·2 to 7·3 kg per metric ton steel.

In estimating future manganese consumption in steelworks it is assumed that for unalloyed steel and low-alloy high-grade steel specific consumption in the Community in its original composition will continue to run parallel to steel output with only minor deviations. Some adaptation in the United Kingdom is to be expected.

In the special steel sector, apart from a higher growth rate than for ordinary steels, a trend towards a higher specific consumption of new manganese can be detected. This is likely to continue in the medium term as a result of the increasing production of special steels, containing manganese, especially alloyed structural steels.

Weighing up the factors which influence future manganese requirements for steel, the mean specific consumption for the whole Community may be expected in the medium term to increase from the current figure of 6·2 kg to 6·5 to 6·6 kg Mn per metric ton steel.

The following approximate figures for manganese ore and manganese alloy requirements are based on the crude steel estimates for the Community and the resulting pig iron production and on the probable development of manganese alloy production in the Community:

(a) Demand for manganese ore for the production of ordinary pig iron grades and of blast furnace ferromanganese:

1973: 2·949 million metric tons

1980: ± 3·4 million metric tons

1985: ± 3·6 to 3·7 million metric tons.

(b) Demand for manganese ore for the iron industry, electrometallurgy and other industries:

1973: 3·4 million metric tons

1980: 4·0 to 4·1 million metric tons

1985: 4·3 to 4·4 million metric tons.

(c) Demand for ferromanganese > 2 % C for consumption in the steel industry assuming medium to good economic conditions for steel production (but ignoring additional demand owing to the return of screened fines):

1973: 0·976 million metric tons

1980: 1·09 to 1·17 million metric tons

1985: 1·18 to 1·27 million metric tons.

(d) Production of ferromanganese > 2 % C in the iron industry:

1973: 1·066 million metric tons

1980: 1·2 to 1·4 million metric tons

1985: 1·2 to 1·5 million metric tons.

The increase to 1·2 million metric tons is justified by the expansion of capacity, especially in France. Further increases are doubtful as the rising prices for ore and coke combined with other high energy costs in the Community should favour competition from producer countries having their own ore resources and/or cheaper energy.

(e) Demand for ferromanganese > 2 % C from imports into the Community (excluding internal trade) for all user industries:

1973: 0·144 million metric tons

1980: 0·25 to 0·35 million metric tons

1985: 0·35 to 0·45 million metric tons.

It is assumed here that future exports from the Community to non-member countries will range from 0·16 up to a maximum of 0·2 million metric tons.

(f) Demand for affiné and suraffiné ferromanganese in the Community steel industry:

1980: 0·185 to 0·2 million metric tons

1985: 0·2 to 0·25 million metric tons.

(g) Total demand for silicomanganese assuming medium to good economic trends in steel production:

1973: 194 170 metric tons

1980: 0·22 to 0·23 million metric tons

1985: 0·24 to 0·255 million metric tons

of which for direct consumption in the steel industry:

1973: 158 000 metric tons

1980: 0·18 to 0·19 million metric tons

1985: 0·2 to 0·21 million metric tons.

A critical review of the above figures indicates that the greatest uncertainty lies in the trend in silicomanganese consumption, apart from its use for the production of affiné and surrafiné ferromanganese. Steelworks experts differ in their views on production techniques and economic results as regards direct use for steel production.

Demand for manganese ores is increasingly being met by a small group of suppliers as smaller deposits are worked out. From the Community standpoint, South Africa, Gabon, Australia and Brazil are the only possible large suppliers in the medium term. No more than marginal quantities can be expected from the USSR with its high domestic consumption and obligations to supply the Eastern European State-trading countries or from India, whose deliveries go primarily to Japan; further factors are the available ore qualities and the prices demanded.

Of the total world production of about 22·8 million metric tons in 1973 (of which 13·3 million metric tons came from non-Communist countries), about 10 million metric tons went to the free market, including marginal exports from the USSR. The US, Japan, Norway and the Community countries purchased 92 % of the total quantities.

With the generally expected increase in world crude steel output (excluding China) to between 1 000 and 1 050 million metric tons by 1985, total demand for manganese ore should rise to 30 to 32 million metric tons, the non-Socialist countries accounting for 17·5 to 18 million metric tons of this figure.

The manganese-ore market is currently stretched as a result of the growing domestic requirements in most producer countries and the inadequate expansion of capacity; the earlier ore surplus has been run down. In the past 10 years either no large new deposits have been found or their economic potential has not yet been evaluated. The opening up of smaller deposits, including those with ores having a special chemical composition such as carbonate ores, is uncertain.

All that remains to cover additional demand is the expansion of capacity, already under way, in manganese ore mines or areas already being worked, but this will not significantly improve the market situation.

Easy access to manganese ores by countries dependent on imports could therefore be jeopardized in the future both by coordinated action on the part of the few large producers and by inadequate prospecting and the growing domestic requirements of the ore mining countries. This is aggravated by the efforts of these countries to obtain a better return from their raw material resources for export by producing manganese alloys themselves as they very often enjoy favourable economic conditions, especially as regards energy.

The Community's iron-smelting industry will therefore have to adapt to structural changes on the market in obtaining its manganese supplies; this also applies to manufacturers of ferromanganese and silicomanganese in the Community, who must expect keener competition from countries having manganese ore resources.

No shortage of supply of manganese resulting from inadequate capacities is to be expected in the medium term, but in view of the small number of suppliers there is always a danger of certain supply bottlenecks owing to unpredictable stoppages of deliveries. It is also impossible to rule out excessive price increases since the supply potential of the manganese market is fully utilized.

Consequently the iron-producing industry and its suppliers in the electrometallurgy sector must take a critical look at their future supply of manganese raw materials and intermediate products.

It appears urgently necessary to step up prospecting and explore the possibility of utilizing special manganese deposits. In addition scientific research into the geochemical processes involved in the formation of manganese ore deposits in desirable so that suitable programmes for the location of such deposits can be established.

F — *ALLOYING ELEMENTS*

Before proceeding to the alloying elements it is useful to examine the trend in production of special steels. The estimates for fine and special steels represent a maximum, this approach being adopted to determine the possibility of supply shortages of alloying elements. The demand for fine and special steels will in fact probably lie below this upper limit.

Special steels

Technical development makes ever greater demands on steel. Consequently the share of special alloy steels in total ingot steel production had already in the past shown an upward trend. This was particularly true in the original member countries of the Community. The United Kingdom expects to follow this trend. This could further accentuate in the Community the already discernible general trend. Output of special alloy steel ingots, 7·8 million metric tons for the Community in 1968, had already risen to 10·3 million metric tons in 1972. Future output is estimated at 16·1 million metric tons for 1980 and, with some reservations, at over 19 million metric tons for 1985.

Previous and estimated future shares of total Community crude steel output accounted for by special alloy steels are shown below:

(million metric tons)

	Crude steel output	Special alloy steels	% share
1968	125·4	7·8	6·2
1972	139·0	10·3	7·4
1980 (upper limit)	183·0	*c.* 16	8·7
1985 (upper limit)	202·0	*c.* 19	9·4

Special alloy steels can be divided into four general categories on a European basis. There were certain difficulties, partly owing to the accession of the new Member States, in allocating the steel types to the various categories in Community countries. For example, it has only been possible since the introduction of EURONORM 20/74, which came into effect in all Community countries on 1 January 1975, to make a clear distinction between special alloy and non-alloy steels. Even within the class of alloy steels, the various groups are not directly comparable or uniformly defined in all the Member States.

The following breakdown was therefore adopted:

(1) Special alloy constructional steels including roller- and ball-bearing steels, valve steels, physical steels, special-purpose constructional steels, maraging steels (1), magnet and heat-conducting steels (1).

(2) Stainless and heat-resisting steels.

(3) Alloy tool steels.

(4) High-speed steels.

(1) Not in all countries.

Trends in the different special steel categories have varied. Three periods were considered in determining development trends: 1965 to 1972, 1972 to 1980 and 1980 to 1985. Unlike forecasts in the raw materials sector 1965 was taken as a basis and not 1968, as for cyclical reasons 1968 is unsuitable as a reference year.

Special alloy constructional steels will show the smallest increase. The annual growth rate of 9·8 % for the period 1965 to 1972 will drop to only 4·6 % for 1972 to 1980. A further decline to little over 3 % is expected for 1980 to 1985. One major reason for the particularly high growth rate up to 1972 was the gradual inclusion of special-purpose constructional steels in the statistics in some countries; it is just these steels that have shown a high increase. Up to 1980 France and the United Kingdom forecast the highest growth because of the expansion of their engineering industries. The Benelux countries also expect a relatively high growth rate with the increased development of low-alloy constructional steels.

The Benelux countries expect this trend to continue to 1985, whereas all the other countries forecast that growth will be slower after 1980 than in the preceding period.

Growth rates for stainless and heat-resisting steels are also expected to remain almost unchanged up to 1980. For the period 1965 to 1972 the annual growth rate was 8·6 %. Up to 1980 it is expected to reach 8·1 % per annum, but a fall to approximately 5·2 % is forecast up to 1985. Italy and the Benelux countries accounted for a major share of the high growth up to 1972, with the United Kingdom recording a relatively small increase. Investment plans in the United Kingdom indicate that an accelerated growth rate may be expected in the coming period. The same applies to France.

In the nine member countries of the Community, the production of alloy tool steels increased by 2·1 % per annum up to 1972. In view of the expectations for increased consumption of these steels in the iron and steel and metal goods industries and in engineering, the annual rise to 1980 should be about 5·3 %. Production figures for 1974 and early 1975 indicate that this growth rate is possible. Account has also been taken of the ground to be made up by the United Kingdom since its accession to the Community. The Benelux countries do not produce tool steels. For the period up to 1985, however, growth is likely to slow down again to 3 %.

The trend for high speed steels is similar to that for alloy tool steels. After a relatively slow annual growth rate of 2·6 % in the period 1965 to 1972 there should be a sharp increase in output of about 6·6 % per annum up to 1980. The main contributory factors will be the growth rates in the engineering and metal goods industries. In countries expecting a particularly high growth rate in this period, a degree of saturation will have been reached by 1980 and therefore the annual increase in output up to 1985 is expected to be considerably lower, probably less than 2·5 % per annum.

For the Community the high annual growth rate of special alloy steels of 8·8 % in 1965 to 1972 will probably decline to 6 % per annum in the period up to 1980. An annual increase of barely 3·5 % will probably be attained in the following years up to 1985.

In the past special non-alloy steels have followed approximately the same trends as alloy steels.

Even though the statistics required for a detailed evaluation are not yet available, it may be assumed that in the future trends will continue to run more or less parallel to those for special alloy steels.

Raw materials

The situation regarding alloying elements in the Community is marked by a steady increase in the use and consumption of special steel and by a growing dependence on imports for raw material supplies. Geological features make it unlikely that large ore deposits will be discovered. Tungsten is the only material of which the Community has known reserves on its territory and even these are far from adequate to meet demand.

There are indications of an above average increase in the consumption of chromium, cobalt, molybdenum, vanadium and nickel in the coming years, while the use of tungsten is likely to decline slightly. Many industrialized countries have become aware of the excellent properties of niobium, consumption of which is rising very steeply.

This trend will also be evident in the Community as a whole. Reserves of these raw materials tend to be concentrated in certain areas and regions outside Europe (e.g. South Africa and Rhodesia for chromium, the American Cordillera for molybdenum, Canada for nickel and for the future the laterite tropical belt for nickel and cobalt, East Asia and China for tungsten) and this can lead to disequilibria between supply and demand, especially as reserves of all alloying elements are concentrated in only a few countries.

Output capacities in the mining sector will have to be doubled over the next 15 years in order to keep pace with the rising demand. It will be necessary to exploit ore deposits that are less rich or of a different nature and this will involve technological and financial problems which above all the developing countries cannot master alone.

Even though it is probable that the manganese ore nodules under the sea will not be exploited economically before the next decade, their possible future substitution for land-based resources must be taken into consideration now since the opening up of new deposits takes several years.

The alloying elements Cr, Ni, Mo, Nb-Ta, W and Co, which are briefly discussed in respect of their source materials in the following paragraphs, may be the subject of supply problems in the short to medium term, but there should be no such problems for other alloying elements (boron, titanium, zirconium, etc.) as far as can be seen from the current situation regarding their use and prospecting.

The use of alloying elements in the steel industry

The use of alloying elements in the making of special steel varies enormously. Ore concentrates can only be used to a limited extent. Further processing to produce ferro-alloys, oxides, salts or metals is necessary. In special steel making, an economic optimum in the use of these elements is desirable. This optimum depends on the steelmaking process and on the chemical composition of the alloy.

Apart from small deposits of tungsten ore, the Community has no reserves for alloy elements of its own. All its supplies have to be imported either in the form of primary material or ores for the manufacture of ferro-alloys.

Imports of ferro-alloys are subject to certain rates of duty which could lead to distortion of competition *vis-à-vis* special steel producers in non-member countries. By 1980 this situation will be relieved somewhat by the gradual dismantling of customs duties payable by the former EFTA countries and by the commercial agreement concluded by the Community.

Production of primary alloy materials requires a high energy consumption and creates environmental problems. The countries producing the raw materials are anxious to obtain the best possible return for their products and therefore want to manufacture the ferro-alloys themselves. Countries such as South Africa or Canada are in a position to do so because they have adequate sources of energy. However, for the Community industries this means that they are becoming increasingly dependent on imports for the intermediate products as well.

In the past chromium, one of the most important alloys, had to contain as little carbon as possible when used for the making of special steels. The double decarbonization process makes its production extremely energy consuming. For some time now increasing quantities of low-carbon crude steel have been made in an oxygen-rich environment and to this ferrochrome and other ferro-alloys with a higher carbon content can be added. This trend will become more marked in the future with the increasing use of AOD converters.

In the nickel sector, sulphide ores used to be dressed and refined to metallic nickel. With the development of laterite (oxidic and high iron-bearing) nickel deposits, these ores are now being processed into ferronickel with contents of around 30 % nickel, which is used directly. Here again a trend towards lower-alloy primary material is evident.

For molybdenum this development took place some 10 years ago and as a result a large proportion of the ferromolybdenum formerly used has been replaced by molybdenum oxide.

These trends show that the Community industries are endeavouring to operate as economically as possible. However, the economies made cannot offset the price increases for raw materials that have been particularly marked in recent years. Therefore provision should be made to organize raw material supply in common.

Chromium

Chromium is one of the most important of the alloying elements, both quantitatively and qualitatively. The major consumer of chromium, mainly in the form of its ferro-alloys Fe Cr and Fe Si Cr, is the iron and steel industry which uses about 65 to 70 % of the supply to make special alloy steels; it is followed by the chemical industry with a share of about 20 % and the refractory industry with about 10 %.

In 1973 world consumption of chrome ores was about 6·7 million metric tons, giving an annual growth rate of over 5 % for the past 10 years. The Community's share in world consumption increased from about 13 % in 1963 to 17 % in 1973; consumption by the Community iron and steel industry recorded an annual growth rate of over 10 % in the same period.

Chromium consumption by the Community special steel industry shows the following pattern:

1968	278 768 metric tons
1972	329 272 metric tons
1980	614 000 metric tons
1985	780 000 metric tons.

As the Community has at present no exploitable chrome ore deposits of its own — Fiskenæsset deposit in Greenland could become important (estimated resreves of 50 to 100 million metric tons of chromite with a Cr_2O_3 content of 44·3 % and Cr/Fe ratio of *c.* 1·2: 1) — all raw materials have to be imported. In 1973 the figures were as follows:

chromite ore	1 235 580 metric tons
ferrochromium	187 755 metric tons
ferro-chrome-silicon	29 499 metric tons
sodium potassium bichromate	12 265 metric tons.

The supply of high-grade metallurgical types of chrome ores is declining.' They are available in only a few countries.

Consequently ores of lower qualities that would not have been used earlier are increasingly being treated and agglomerated by sintering or pelletizing. The poorer quality of these fine ores is compensated by better preparation techniques.

The chemical industry uses the ore fines directly; the higher Fe contents are no disadvantage because they make the chromium more easily soluble. Almost 80 % of chrome ore comes from the USSR, South Africa, Rhodesia and Cuba. These countries also supply the majority of the metallurgical ore. Small quantities come from deposits in South Africa in which Community companies have holdings.

Proven and probable world chrome ore reserves are estimated at between 3 000 and 5 000 million metric tons. Although the USSR is currently the largest chromite producer with a share of almost 30 %, its known reserves are fairly modest. By far the majority of the known reserves are in South Africa (70 %) and Rhodesia (20 %).

Countries such as Finland, India, Madagascar, the Philippines, Turkey, Brazil, etc. are of lesser importance. A comparison of world reserves with world mine output shows that in the foreseeable future, there is no danger of a shortfall in the supply of chrome ore due to reserves being exhausted. The only obstacle to a smooth and secure supply is the vulnerability resulting from the small number of producers. As regards the future chromium market, the iron and steel industry's share in Community chromium consumption will continue to rise and by 1985 should exceed 75 %, allowing for the increasing use of chrome ores for foundry sands.

Nickel

Nickel is an irreplaceable alloying element, especially for special stainless and heat-resisting steels and special constructional and tool steels. The iron and steel industry accounts for about 75 % of nickel consumption, with most of the remaining 25 % divided between the galvanizing industry and non-ferrous alloys.

World nickel consumption in 1974 reached a new peak of 662 000 metric tons compared with 654 000 metric tons in 1973. The Community's share has, however, increased very little in the past decade (20·9 % in 1962 and 22·1 % in 1973).

Past and estimated future consumption for special steel production in the Community is as follows:

1968	106 400 metric tons
1972	126 300 metric tons
1980	217 000 metric tons
1985	270 000 metric tons.

This corresponds to an annual growth of 6 to 7 %, partly based on export expectations and partly on plans in the power station (nuclear, gas, electricity, etc.) and the marine sector (desalination plants). However, a marked increase in consumption is also expected in the non-metals and petrochemical sectors and this must also be taken into account.

World nickel production was about 685 000 metric tons in 1974 (666 000 metric tons in 1973) with Canada supplying 260 000 metric tons (38 %), followed by New Caledonia (112 000 metric tons), Australia (45 000 metric tons), Cuba (32 000 metric tons), the Dominican Republic (30 000 metric tons), South Africa (20 000 metric tons) and Finland (6 000 metric tons). USSR production of 125 000 metric tons went mainly to meet its own requirements.

Data on world nickel reserves vary enormously, ranging from 50 to 70 million metric tons. Sulphide ores account for barely 25 % of this. Although intensive prospecting in recent years has led to the discovery of many deposits all over the world, about 80 % of the reserves are found in five countries, Cuba and New Caledonia (20 % each), Canada (15 % sulphide), USSR (13 % some of it sulphide) and the Philippines (7 %).

A comparison of current and future producing countries shows that the emphasis will shift strongly towards the developing countries which with their laterite deposits possess almost half the world nickel reserves.

In the past, the International Nickel Company of Canada (INCO), with a market share exceeding 50 %, has dominated the market. A surplus on the market leading to a drop in prices was avoided by controlling production. In recent years a free market price that has on occasion been ten times the producer price has existed alongside the producer price because of the shortage of supply caused by strikes.

Producer prices show an annual increase of 10 %. Further increases are to be expected in the future as the prime costs for the laterite ores that are increasingly being mined are considerably higher than those for sulphide nickel ores.

The chances that projects currently under investigation will actually be carried out are complicated and in some cases even jeopardized by the growing unwillingness to invest. Although supply and demand can be kept in balance in the immediate future, supply difficulties cannot be ruled out when demand continues to increase after 1980. However, consortia of Community firms have recently been stepping up their efforts to build up their own supply by participating in the development and exploitation of nickel ore deposits in almost all continents.

Molybdenum

Because of the physical properties of molybdenum (increase in heat resistance, prevention of brittleness, etc.), about 85 % is used in the special steel industry. The remainder is used for the manufacture of lubricants, rust inhibitors, catalysts, pigments and in powder metallurgy.

The Community countries are completely dependent on imports from non-member countries. Molybdenum consumption by the Community special steel industry is as follows:

1968	14 500 metric tons
1972	16 800 metric tons
1980	30 000 metric tons
1985	37 500 metric tons.

This gives a future annual growth rate of about 6 %.

In 1973 molybdenum consumption in the free world was 74 800 metric tons, slightly above the annual production of 68 500 metric tons. In 1974 again even more molybdenum was used than produced. However, this deficit was made up by releasing about 17 000 metric tons from the GSA reserves. Four countries account for 96 % of current annual output, i.e.:

US	65 %
Canada	14 %
USSR	10 %
Chile	7 %.

World reserves of about 5·5 million metric tons are distributed as follows:

US	50 %
USSR	16 %
Chile	15 %
Canada	8 %
China	8 %.

If the current growth of 5 % in output is maintained, the supply for the immediate future will only be partly secured. About 50 % of the molybdenum produced comes from porphyritic copper ore deposits and can only be extracted as a secondary product.

This means that the molybdenum market is very dependent on the copper market and subject to the same fluctuations. The relatively high producer stocks have so far been adequate to prevent a shortage. Since the end of 1974, the GSA stockpile has been exhausted so that a shortage of molybdenum is to be expected in the coming years, especially as there are no prospects of the development of new large deposits anywhere. The low quality ore reserves of Malmbjerget in the Werner mountains of Greenland could in future be of interest to the Community. Here there are deposits of some 120 million metric tons of ore with a content of 0·25 % Mo with a cut-off grade of 0·17 % Mo.

Vanadium

About 85 % of vanadium consumption is in form of ferrovanadium used in the steel industry for special and high-grade steels; the remainder is divided between non-ferrous alloys (10 %), the chemical industry (3 %) and other uses (2 %).

Currently vanadium consumption in the western world is 21 000 metric tons, of which about 7 500 metric tons is consumed by the US.

The increase in the Community special steels industry's requirements up to 1985 is estimated as follows:

1968	2 649 metric tons
1972	3 939 metric tons
1980	7 200 metric tons
1985	8 500 metric tons.

A consumption of about 11 250 metric tons is estimated for the US in 1985. This corresponds to an annual growth rate of around 7 % for both the Community and the US. With an increase of this order world vanadium consumption should be 28 to 30 000 metric tons.

Exploitable vanadium reserves are estimated to be 10 million metric tons of metal, 60 % being in the USSR, 20 % in South Africa and 15 % in Australia. The majority of vanadium today comes from titanium magnetite deposits (70 %) and uranium deposits of the Colorado type (25 %); in both cases vanadium is a by-product. The small high grade ore deposits are nearing exhaustion. There are potential vanadium reserves in bauxite, phosphorite and petroleum deposits but a new technology would have to be developed to exploit them on a large scale.

In the Community, only France produce small quantities as a by-product of aluminium manufacture. In the rest of Europe, vanadium-bearing ores are extracted and converted to ferrovanadium only in Finland (Otanmäki 1974: 2 649 metric tons) and Norway.

The price of vanadium pentoxide has fluctuated around $ 2 per lb. In 1974 37 000 metric tons of vanadium pentoxide were produced, with South Africa (40 %) the US (25 %) and the USSR (about 15 %) providing over ¾ of the world supply. The difference between production and consumption is indicated by stock levels which benefit from the yield of intermediate vanadium products from iron and vanadium processing.

The Community should in the short-term experience no immediate difficulties in its supply of vanadium raw materials. Even if demand increases (e.g. for the production of oil pipelines or nuclear power generators) it could be met provided none of the three large producers (Union of South Africa, US, USSR) decided to suspend deliveries for a long period.

Niobium-tantalum

Niobium and tantalum ores are generally found in conjunction with acid granite intrusions (often accompanied by tin and tungsten ores) and with carbonate extrusive rocks. About 85 % of the total consumption of niobium goes to the steel industry, compared with only 5 to 10 % of tantalum. These elements are also used in the electrical engineering industry, in the hard metal industry and in the form of non-ferrous alloys.

In the steel industry they are used as stabilizers, as alloys for steels to withstand high pressure and temperatures and for the production of steel casting moulds. Other important applications are turbine construction and low-alloy steels for oil and gas pipelines. Research is still in progress into the possible applications of both elements. The major products are ferroniobium and ferroniobium-tantalum. Ferrovanadium can to a limited extent be replaced by ferroniobium. Figures on past consumption are inaccurate. No data exist for the State-trading countries.

It is not possible to make forecasts for the special steel sector.

In 1973, the enlarged Community used about 3 000 metric tons Nb_2O_5 and the western world about 7 000 metric tons. Tantalum consumption in the western world was 1 100 metric tons Ta_2O_5. Up the beginning of 1970 an annual consumption growth rate of 5·5 % was recorded. Because of the advantages of Nb-Ta in special steel production this figure has soared to about 13 % since 1972, with growth rates of up to 30 % in the low-alloy steel sector.

Of the western world's output of 13 000 metric tons Nb concentrate (= 7 100 metric tons Nb_2O_5) in 1973, Brazil alone supplied 7 760 metric tons (60 %), Canada 2 800 metric tons (20 %) and Nigeria 1 250 metric tons (10 %). The remainder came from Zaire, Mozambique, Thailand, Australia and Malaysia. The production of tantalum-pentoxide was only 590 metric tons; a proportion of the metal consumed was drawn from the reserves.

Despite the spectacular rise in consumption there are no difficulties at world level for the future supply of either of these elements. According to US Geological Survey Professional Paper 820 proven reserves are estimated as follows:

	Nb_2O_5 (million metric tons)	Ta_2O_5 (thousand metric tons)
North America	1·92	6·5
South America	9·05	5·5
Europe	0·14	—
Africa	2·74	60·0
	13·85	72·0

There are major mining projects in Brazil (Araxa) and Canada (Chicoutimi). The existence of these two gigantic deposits makes it more difficult to develop other possible projects, especially in Africa. This means that the Community industries are dependent on imports from a very few producers who are mainly geared to the American market. As there are considerable fluctuations in demand (e.g. speeding up of the US oil pipeline programme) the European steel industry will be the first to suffer from a shortage.

Tungsten

In the Community about 30 % of tungsten consumption is accounted for by the alloying elements sector proper

high-speed steels	18 to 25 %
tool steels	4 to 5 %
other ferro-alloys	2 to 3 %.

The majority goes to the hard metal industry (40 to 50 %) with the remainder divided between the pure metal (15 to 20 %, mostly in the electrical engineering industry), non-ferrous metal alloys (6 %) and the chemical industry etc. (7 %). As the hard-metal industry will continue to show above-average growth, its share of total consumption will increase.

At present ten countries supply 84 % of world output (about 300 mines); the largest quantities come from the Eastern bloc (45 %), mainly from China and the USSR.

World output which fluctuated greatly in 1965 to 1973, now appears to be steady at about 38 000 metric tons tungsten content per annum; in the longer term a growth rate of 3 to 4 % is expected, so that after 1980 output should reach 40 to 50 000 metric tons a year.

Existing mining capacity and known projects indicate that this increase in output is feasible.

Of the Western countries, the US, Canada, Australia and Portugal have a considerable output (at least 20 % of world production), but there are also hopeful developments in the Community. For example, France is currently obtaining about 50 % of its requirements from its own ores. However, the world demand of tungsten has been met in recent years only by the release of certain amounts from the GSA stockpile.

In the special steel industry the increase in the demand for tungsten is taking a less dramatic course than that for the other alloying elements, one of the reasons being that it has a strong rival in molybdenum, for example in the manufacture of high-speed steels. Accordingly the trend in the special steel industry's requirements in the Community will be as follows:

1968	5 650 metric tons
1972	5 250 metric tons
1980	7 200 metric tons
1985	7 700 metric tons.

World tungsten reserves are estimated at 1·6 to 1·8 million metric tons of metal.

Apart from the general uncertainty of this figure, it must be remembered that it relates to a price level of £ 17 to £ 18 per unit. After a temporary rise to £ 50, prices now seem to be stabilizing at a level of £ 35 to £ 40 per unit, and this will lead to an increase in production potential. But it should be borne in mind that 80 % of these reserves are estimated to belong to the Eastern bloc, 55 % in China alone. Because of this situation temporary supply bottlenecks cannot be ruled out in the near future, but these will affect the special steel industry much less than the hard metal industry.

Cobalt

About 85 % of the world cobalt consumption goes to the steel industry. The rest is used in the form of oxides or salts by the glass and ceramics industry, in catalyst production, etc.

In 1974, the free world used 27 900 metric tons of cobalt, 23 500 metric tons of which went to the steel industry. Because it increases tensile strength and hardness and improves hardness retention and heat resistance, it is used in the manufacture of tool, high speed and maraging steels as well as stainless and heat-resisting steels.

The following increase in consumption in the Community special steel industries is expected, mainly on the basis of the future prospects for high-speed steels:

1968	1 688 metric tons
1972	1 600 metric tons
1980	3 000 metric tons
1985	3 700 metric tons.

The growth rate of 6·3 % corresponds to that for the whole of the western world for the years 1950 to 1974.

World output excluding the State-trading countries was about 24 550 metric tons new cobalt in 1974. The Republic of Zaire alone produced more than 17 500 metric tons of this (over 70 %) and together with Zambia, Canada and Morocco accounted for 95 % of total output. Proven world reserves are currently estimated at 2 500 000 metric tons cobalt-in-ore, distributed as follows:

developing countries	56 %
industrialized countries	36 %
Eastern bloc	8 %.

The largest reserves are in Zaire (27·5 %), New Caledonia (27 %), Zambia (14 %) and Cuba (13·6 %).

There are no pure cobalt deposits: ores exploitable at the present time are associated with copper, nickel or copper-nickel deposits.

Prices for cobalt, which in the past 20 years, although rising, have been more stable than prices for other alloying elements, are likely to increase rather more in the future as the dressing of laterite Ni-Co ores is more costly than that of sulphide ores, the proportion of which is declining sharply.

A further source of the raw material, the manganese ore nodules containing cobalt, nickel and copper found on the ocean floor, is unlikely to make any impact on the world market before 1985 as the technologies required and the enormous prime costs will make large-scale economic exploitation impossible in the immediate future.

In the medium term, the negative balance between supply and demand indicates that the supply situation is likely to worsen, as producers' buffer stocks and the USA's strategic reserves are dwindling. In addition, new mining projects for laterite ores are developing more slowly than expected.

The Community countries are dependent for 60 % of their supply on imports from Zaire and Zambia.

Another factor is that cobalt is mostly obtained as a by-product of copper or nickel production. A decline in the output of these elements is not expected.

CHAPTER IX

ENERGY

A — *CONSUMPTION*

Increases in the price of energy and temporary shortages of energy-bearing materials make it necessary to introduce chapters on energy consumption and supply into the General Objectives, since the steel industry is one of the most important energy consumers and its energy costs are a relatively high (about 20 to 25 %) proportion of total costs.

The evolution of energy consumption in the past has been affected by three main factors.

— The decrease of the Community's global specific energy consumption in the steel industry is due to the input of higher-graded ore. Other factors leading to energy economy — bigger and better installations, the spread of the use of continuous casting and so on — have been more or less cancelled out by factors involving the use of more energy such as more reheating of billets and blooms, the higher proportion of thin sheets and the production of more sophisticated goods.

— There has been a high degree of inter-substitution between energy materials: mainly in the substitution of coke by oil and gases. The effect of this is that even in certain fully integrated steelworks where coke and derived gases were once sufficient for their total energy consumption, and where there were even possibilities of selling derived energy in the form of electricity or gas, there is now a need to purchase some electricity, gas and oil.

— Because of the different energy and raw material situations in the Community there is a large difference in the total energy consumption patterns per ton of crude steel between the individual countries. Italy, for example, has always been heavily dependent on scrap consumption, and pig-iron has always been produced there by the use of high-grade foreign ores. So in Italy the total specific energy consumption pattern is by far the lowest whilst in France and Luxembourg, where scrap consumption has been relatively low and pig-iron production is based mainly on low grade indigenous ores, specific energy consumption is high.

In the future:

— there will be greater use of high-grade ore, and

— the ratio of scrap to pig-iron will increase.

Under the assumption that there are no fundamental changes in production methods we make the following estimates of consumption of the main energy-bearing materials in the Community iron and steel industry for the years 1980 and 1985, based on the picture as it was in 1973.

Coal and other solid fuels except coke

Consumption of these fuels is essentially in sinter and power production. We assume that coal consumption for sintering will increase *pro rata* with pig-iron production. On the other hand we are assuming no increase in production of power within the plant, since the optimal capacity exceeds the requirements of a single enterprise and since the availability of blast furnace gases is diminishing.

Coke

Coke accounts for some 52 % of the energy consumed in the iron and steel industry. Its significance lies in the fact that it is a raw material for the reduction of iron ore. Therefore up to a certain limit nothing else can be substituted for it in blast furnaces. The coke rate in blast furnaces decreased from 970 kg in 1955 to 526 kg in 1973 (for the Community as originally composed) (533 kg in 1973 for the enlarged Community). This evolution was mainly due to

— the growing use of richer ores,

— the advancement and wider diffusion of techniques of agglomeration of ores and of charge preparation,

— developments involving injection of fuel oil, with a rate of substitution for coke in the region of 1 for 1,

— a marked increase in air blast temperatures.

The influence of richer ores cannot be ignored. One should note, however, that otherwise the significant decrease of specific consumption of coke in blast furnaces is not reflected in an equivalent economy in energy. In fact coke has essentially been replaced by fuel oil, coals and coke breeze mixed with ore in the sinter plant, and more gases or oils used to increase blast temperatures. One should also remember that the production of blast furnace gas has decreased more or less *pro rata* with the consumption of coke while at the same time its calorific value has deteriorated.

In 1973 the specific consumptions, which include fuel oil injection, were:

	Kg per metric ton of pig-iron
Coke	533
Fuel oil	51
Total	584

In the future the total additional pig-iron production will come from rich foreign iron ores, implying economies of energy. Also ore preparation (sintering, pelletization, homogenization of burden) will be improved further, and the modernization of old blast furnaces (by improvement of top pressures and higher blast temperatures etc.) will result in further energy changes. On the other hand, the reduction of specific consumption, which is reaching its lower theoretical limit, is also restricted by the use of some lower-grade ores and by the fact that we foresee only a small increase in specific fuel oil consumption.

Consequently, we calculate that specific coke consumption in blast furnaces will fall to 505 kg per metric ton of pig-iron (349 kg per metric ton of crude steel) for 170 Mt of production of steel and 500 kg per metric ton of pig-iron (345 kg per metric ton of crude steel) for 183 Mt of production of crude steel in 1980, and to 490 kg per metric ton of pig-iron (or 328 kg per metric ton of crude steel) in 1985.

Coke consumption other than that in blast furnaces is mainly for sintering purposes. Our forecast is that its specific rate per metric ton of pig-iron, which was 68 kg in 1973, will be maintained.

Fuel oil

In 1973 consumption of fuel oil in blast furnaces was 51 kg per metric ton of pig-iron. Due to the uncertainties of the oil market it is difficult to forecast the progress of oil injection in the future. However, since the fuel oil consumed in blast furnaces is virtually a residual product of the refining process and its transformation into higher graded products is very costly, we assume that refineries will be prepared to offer it at a price which will enable it to continue to be used as a substitute for coke. Therefore, we have assumed a specific consumption in blast furnaces of 60 kg per metric ton of pig-iron in 1980 and 1985. Technically, of course, a higher specific consumption is perfectly feasible, and could come about given suitable economic conditions.

In 1973 consumption of fuel oil in the Community iron and steel industry other than in blast furnaces was 48·3 kg/metric ton of total steel produced. We forecast that in all installations other than open-hearth furnaces the specific consumption will remain constant. On one hand the closure of open-hearth installations will cause a decrease, but on the other hand an increase will be caused by a lower supply of blast furnace and coke oven gas because of a lower coke rate. Decreases of 7·8 kg in 1980 for 170 Mt of production and 6·8 kg for 183 Mt of production; 9·3 kg in 1985 for 188 Mt of production and 8·3 kg for 202 Mt of production are forecast. But increases of 6·5 kg in 1980 and 13 kg in 1985 (both levels of production) bring the net specific consumption to 47 kg and 48 kg for 170 Mt and 183 Mt production respectively in 1980 and 52 kg and 53 kg for 188 Mt and 202 Mt production respectively in 1985.

Natural gas

In 1973 consumption of natural gas was 74 Kce per metric ton of steel produced. In 1980 the increase in continuous casting will reduce this quantity by 9·0 Kce and the closure of open-hearth furnaces by 1·0 Kce. On the other hand the extension of direct reduction will increase this figure by 3·9 Kce.

We assume that otherwise the consumption will remain constant, giving 68 Kce specific consumption per metric ton of steel in 1980 for both levels of production and 71 Kce and 70 Kce for production levels of 188 Mt and 202 Mt respectively in 1985.

Derived gases

We assume that the availability of derived gases will stay at the same level per metric ton of steel as it was in 1973, 54 Kce, and we shall take the same figure for 1980 and 1985. A reduction of this supply would have to be compensated for by an increase in the supply of natural gas or fuel oil.

Electricity

In 1973 18·3 milliard kWh (27·3 % of the 67·1 milliard kWh of electricity consumed by the Community iron and steel industry) was produced by the industry itself. 48·8 milliard kWh (72·7 % of consumption) was purchased. Of the 18·3 milliard kWh auto-produced, 15·2 milliard was produced by blast-furnace gas, and 3·1 milliard was produced from coal, fuel oil and natural gas.

In the future it is assumed that all supplementary electrical energy will be purchased, and the specific consumption of electricity used in the industry other than in steel production will remain constant at 350 kWh per metric ton of total steel produced. In steel production consumption of electrical energy will increase considerably because of the higher percentage of electric steelmaking (21·2 % of total steel in 1980 and 22 % in 1985 as against 15·3 % in 1973) and the increase of oxygen consumption in oxygen converters, where a high energy consumption is necessary.

Consequently we expect total electrical energy consumption per metric ton of steel to increase from 447 kWh in 1973 to 486 and 489 kWh in 1980 (for productions of 170 Mt and 183 Mt respectively) and 491 kWh, 493 kWh in 1985 (for productions of 188 Mt and 202 Mt respectively).

Because of the constancy of electrical energy production by blast furnace gases the growth of purchased electrical energy is even more pronounced:

	1973	1980 (170 Mt)	1980 (183 Mt)	1985 (188 Mt)	1985 (202 Mt)
kWh metric ton of steel	346	397	406	410	417
The future purchases in total are forecast to be					
10^9 kWh		67·5	74·3	77·1	84·3

of which 3·1 milliard kWh in each year and at each level of production is produced by steel industry owned power plants not driven by furnace gases.

As the first table shows, total energy consumption per metric ton of steel will decrease only modestly, as in the past. On the other hand the continued substitution for solid fuel by fuel oil, gases and electricity is quite marked, the share of solid fuels falling from 55 % in 1973 to 49 % in 1985. The share of electricity over the same period increases from 13·8 % to 17·3 %, and part of the investment required to meet this demand will have to be made by power stations outside the steel industry.

Our calculations allow for only a very small quantity of prereduced material; if all projects in third countries aimed at increasing the supply of this material come to fruition there will be a decrease in the overall Community iron and steel industry energy requirement but on the other hand the electrical energy requirement will rise.

Energy consumption

	1973			1980 (170 Mt)			1980 (183 Mt)			1985 (188 Mt)			1985 (202 Mt)		
	total x 10^6tce	Kce/t steel	%	total x 10^6tce	Kce/t steel	%	total x 10^6tce	Kce/t steel	%	total x 10^6tce	Kce/t steel	%	total x 10^6tce	Kce/t steel	%
Coal and other solid fuels	3·9	26	3·1	4·1	24	3·0	4·3	23	2·9	4·2	22	2·8	4·4	22	2·8
Coke for blast furnaces	57·0	380	46·1	59·3	349	43·3	63·2	345	42·8	61·7	328	41·3	66·3	328	41·1
Coke other than for blast furnaces	7·3	49	5·9	8·0	47	5·8	8·6	47	5·8	8·6	46	5·8	9·2	46	5·8
Coke total consumption	64·3	429	52·0	67·3	396	49·1	71·8	392	48·6	70·3	374	47·1	75·5	374	46·9
Fuel oil for blast furnaces	8·2	55	6·7	10·6	62	7·7	11·4	62	7·7	11·3	60	7·5	12·2	60	7·5
Fuel oil other than for blast furnaces	10·9	73	8·8	12·0	71	8·8	13·2	72	8·9	14·7	79	9·9	16·1	80	10·0
Fuel oil total consumption	19·1	128	15·5	22·6	133	16·5	24·6	134	16·6	26·0	139	17·5	28·3	140	17·5
Natural gas	11·1	74	9·0	11·6	68	8·4	12·4	68	8·5	13·3	71	8·9	14·1	70	8·8
Derived gases	8·2	54	6·5	9·3	54	6·7	9·9	54	6·7	10·2	54	6·8	11·0	54	6·8
Electricity	17·1	114	13·8	22·3	131	16·3	24·5	134	16·6	25·4	135	17·0	27·8	138	17·3
Total	123·7	825	100	137·2	806	100	147·5	805	100	149·4	795	100	161·1	798	100

	Coefficient of conversion from MTce	Units	1973	1980 (170 Mt production)	1980 (183 Mt production)	1985 (188 Mt production)	1985 (202 Mt production)
Coal and other solid fuels	1	10^6 metric tons	3·9	4·1	4·3	4·2	4·4
Coke for blast furnaces	1	10^6 metric tons	57·0	59·3	63·2	61·7	66·3
Coke other than for blast furnaces	1	10^6 metric tons	7·3	8·0	8·6	8·6	9·2
Coke total consumption	1	10^6 metric tons	64·3	67·3	71·8	70·3	75·5
Fuel oil for blast furnaces	0·666	10^6 metric tons	5·5	7·1	7·6	7·5	8·1
Fuel oil other than for blast furnaces	0·666	10^6 metric tons	7·3	8·0	8·8	9·8	10·7
Fuel oil total consumption	0·666	10^6 metric tons	12·8	15·1	16·4	17·3	18·8
Natural gas	7	10^9th	77·7	81·2	86·8	93·1	98·7
Derived gases	7	10^9th	57·4	65·1	69·3	71·4	77·0
Electricity	3	10^9kWh	51·3	66·9	73·5	76·2	83·4

B — *ENERGY SUPPLIES*

Coke and coking coal

The question of the supply of coke to the steel industry should be examined in conjunction with trends in the Community's overall requirements in coke. In 1973 as much as 15·6 million metric tons of coke were still consumed outside the steel sector by the remaining industrial and domestic markets. In these sectors the reduction in sales will continue in the long term, although the rate will probably slow down as compared with the period before the oil crisis. If it is assumed that net exports will stabilize at roughly the pre-1974 level, the following overall long-term developments are probable:

Coke — Community requirements and production

(million metric tons)

	1973	1980		1985	
		I	II	I	II
Steel	64·3	66·8	71·3	69·8	75·0
Other domestic sectors	15·6	10·5	10·5	8·0	8·0
Net exports	3·9	2·5	2·5	2·5	2·5
Total requirements	83·8	79·8	84·3	80·3	85·5
Production	81·8				

In the peak year of 1974, about 87 % of the Community's coking capacity of 94·5 million metric tons was used. Available information on plans for new coke ovens and for closing down coking plant indicates that by 1980 there will be a slight increase to 97 million metric tons in production capacity. If a total capacity of this order is maintained until 1985, total requirements even for the upper forecast (85·5 million metric tons) could be covered. In addition it would always be possible to fall back on reserve supplies by more intense utilization of the capacity and using up stocks, as is always the case in periods of peak market demand.

On the basis of foreseeable developments, the share of blast-furnace coke ovens in total coking capacity would increase from 49 % in 1974 to 55 % in 1980. The capacity of the coastal coke ovens would at the same time increase to about 25 million metric tons of coke.

In 1974 the amount of coking coal charged in the coking plants amounted to 107 million metric tons of which 88 million metric tons was Community coal and 19 million metric tons from non-member countries. The forecasts for coke requirements given above would indicate that the Community demand for coking coal will stabilize in the long term, with lower and upper forecast values of 104 million metric tons and 111 million metric tons respectively for 1985. The question as to whether these requirements can be met must be examined in conjunction with the general prospects for coal and/ or aims of the Community's coal policy.

In a resolution of 17 December 1974 the Council approved quantified aims for a common energy policy. These provide for a long-term increase in solid fuel consumption, as already proposed by the Commission in its communication to the Council of 12 November 1974 concerning 'Medium-term guidelines for coal 1975 to 1985' (1). For this purpose the output of hard coal in the Community should be maintained at its present level of approximately 250 million tce up to 1985, subject to satisfactory economic conditions, and coal imports should be increased to 57 million metric tons (40 million t.o.e.).

In order to achieve long-term stabilization in production, output in Great Britain and the Federal Republic of Germany would have to increase slightly as, for reasons of efficiency and because reserves are running out, output in France and Belgium will decrease. Long-term commitments by consumers to take as large a proportion as possible of coal production, a policy which the mining companies have in the meantime partially initiated, are a prerequisite for the investment required for maintaining capacity.

In view of the varying trends of output of the different coalfields, no increase in the production of coking coal in the Community is likely. Output may even decrease slightly unless production, which is tapering out in some mines, e.g. in the Nord/Pas-de-Calais coalfield, is balanced by transferring coking coal from other applications, or by an extension of the range of coal suitable for transforming into coking coal through the introduction of new coking coal processes (e.g. formed coke).

Under Commission Decision 73/287/ECSC (2) which is valid until 31 December 1978 the steel industry will cover its requirements primarily with Community coal. This decision sees the supply arrangements basically as the responsibility of the undertakings. The Commission wants however to ensure that the support from Community sources is accomplished on the basis of long-term contracts. When these conditions are fulfilled the decision empowers the Governments of the Member States to grant aid and permits the alignment to a calculated cost price of competitive coal from third countries.

In its 'Medium-term guidelines for coal 1975 to 1985' the Commission advocated the view that the maintenance of long contracts would also be necessary for the period 1979 to 1985. In the light of the long-term outlook for the world coking coal market it seems desirable to the Commission to envisage adequate controls for the above period.

As concerns imports of coking coal there are indications that there will be a further increase in the medium term favoured by the increase in coastal coke-oven capacity. The chief supplying countries are likely to be the United States, Poland, Australia and the USSR. Recently Community undertakings, the latest including mining companies, have to an increasing extent acquired shareholdings in coking coal undertakings in non-member countries. These holdings particularly reflect the need for security in respect of the quantity and price of imports. Additional long-term contracts have been concluded with Poland as part of special cooperation agreements.

To sum up, these tendencies permit the conclusion that it will probably be possible to meet the slight long-term increase in the Community's coking coal requirements without much difficulty. Although it is not yet possible to make a reliable forecast of the quantities which will be required up to 1985, it is likely that the steel industry will turn even more to the world market. As long as there are no fundamental changes in the energy market, it is to be expected that supplies put on the market by non-member countries will increase accordingly. As the Commission called for in their proposals for coal

(1) OJ No C 22, 30. 1. 1975.

(2) OJ No L 259, 15. 9. 1973.

import policy within their 'Medium-term guidelines for coal 1975 to 1985'; the coal consumers of each of the Community countries must have the same access to the world market for coal in order to permit the opening up of additional supply sources on the necessary scale. However, the Community's production of coking coal will retain its present status as the main source of supplies to the steel industry.

Oil

The supply of oil is subject to many uncertainties due to the changed circumstances on the oil market. The oil-producing countries actually control, to a certain extent, quantities and prices of crude oil and the role of the oil companies has been decreased.

On the other hand, we see the development of new deposits of oil (North Sea) and alternative sources, and a tendency towards a rational use of energy.

All of these factors — to which some important non-energy factors can also be added — make estimations about the supply of crude oil rather speculative with less problems on the quantity side than on the price aspect. As far as heavy fuel oil is concerned the possibility must be taken into consideration that the consumption packet will change with a larger proportion of 'light' products, especially gasoline. This will be achieved, on the one hand, by the construction of cracking and refinery installations and, on the other, by the fact that the average barrel of crude oil will be lighter, thanks to the increasing production of crude oil from the North Sea.

This could mean that heavy fuel oil will be in less of a surplus position than it is now and that on average the price of heavy fuel oil will become higher, certainly for heavy fuel with a low sulphur content.

Electricity

The electricity supply industry is well placed to meet the increasing requirements of the steel industry in the early 1980's. The present economic recession has affected the growth in electricity demand and current forecasts indicate that the growth rate in many Community countries is unlikely to return to normal for several years. There should be, therefore, adequate generating plant capacity to ensure security of electricity supplies in the Community and to meet the expected requirements of the steel industry up to the early 1980's.

However, in the longer term, the provision of suitable sites for new power stations, principally nuclear, will become an increasingly important part of the development programme in the electricity sector. Efforts will be required by all parties concerned to ensure that problems concerned with the choice of suitable power station sites, authorization procedures and excessive lead times are overcome.

It is, however, essential that the steel industry, in making plans and setting its targets for the period 1980 to 1985, collaborates closely with the electricity industry to ensure the continued adequacy of generating plant capacity for their needs in the period 1984 and beyond. Lead times for the building and commissioning of new generating plant are of the order of five to nine years and the activity level of the steel industry itself is influenced by orders for new electricity generating plant. The use of new technologies in the steel industry, and the increased use of technologies which effectively substitute electricity for other fuels or increase the electrical energy consumption per metric ton of steel produced, represent increases in electricity demand which the electricity supply industry must plan to meet in the years ahead.

The impact of increased fuel costs and other factors, such as inflation and increased investment costs, has recently caused sharp increases in charges for electricity throughout the Community. The increasing part of electricity supplies which will be generated by nuclear power will in due course better the conditions of supply of electricity. This development may begin to be felt in the period 1980 to 1985. The steel industry should, in making forward investment decisions, carefully consider the advantages of the increased use of a reliable electricity supply at predictable and stable costs for all applications for which this form of energy is especially suited.

Natural gas

Because of the growth in gas consumption set as an objective for 1985 by the Community, additional quantities will become available on the market from new sources throughout the period. The steel industry, whose consumption according to the calculations in these General Objectives will grow by around 25 % through to 1985, could be one of these new consumers. It should, however, be borne in mind that gas, because of its favourable environmental and easy handling characteristics should be above all directed towards those consumer groups where its specific qualities can be utilized to the maximum extent.

Nuclear energy

At present nuclear energy is used solely to produce electric current in low-temperature power stations. Specialists in the nuclear sector are of the opinion that atomic heat could be used with greater efficiency by passing it through high-temperature reactors (HTGR) in which a gas such as helium would carry heat at 900 ° or 950 °, would first exchange part of that heat in chemical reactions to produce the reducing gases H_2 and/or CO from various products such as fossil fuels or even water, and would only then pass through the turbines to generate electrical energy.

The future situation might well be as follows: an HTGR nuclear reactor would be the centre of an integrated steel works. Installed in a star pattern around the reactor would be a number of exchangers producing hot reducing gases (about 700 °); as described above, the gases would be used in installations for the direct reduction of iron ore; and the pre-reduced products so obtained would be transformed into steel in electric arc furnaces supplied with current also produced on site.

However attractive such a solution might appear to the uninformed observer it must be recognized that such an overall vision is certainly not realistic in respect of the next 20 years.

Leaving aside the fact that our experimental knowledge of manufacturing reducing gases in exchangers under the conditions required by HTGR reactors is still insufficient, the model factory described above would raise enormous problems with regard to regulations, siting in industrial centres, reliability of the reactor, etc.

Besides it would not be wise to make the transition from familiar conventional steel-making processes to a chain of processes which are still fraught with uncertainty and unknowns, i.e. integrated nuclear steel making.

Steel manufacturers have therefore realized that they will have to proceed in stages. They feel that reducing gases (pure H_2 or H_2 + CO mixed) which would be supplied at competitive prices by HTGR reactors might be interesting. These gases, which would also be useful for other industrial sectors such as the chemical industry, could be distributed by gas pipelines to the point of use and, therefore, more particularly to conventional steelworks which would use them mainly in blast furnaces or possibly in direct reduction units.

As recent experiments in blast furnaces have shown, the gases could be used as substitutes for metallurgical coke, being either injected cold through the main nozzles or hot into the bosh. They could also be used for heating the furnaces.

In view of the time needed for creating such new reactors on an industrial scale it is possible that one or two atomic power stations on these lines might be constructed in the Community after 1990. Any such station would be built at a reasonable distance from steel-using or chemical-consuming centres in order to facilitate distribution by pipeline.

Any future developments in the nuclear industry will have many varying effects on the steel industry in both its roles — as consumer of energy and as producer of manufactured products.

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