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OBSERVATIONS ON THE COAL INDUSTRY

Prepared by the MINING ASSOCIATION OF GREAT BRITAIN

Communicated by Mr. W. T. LAYTON and Sir Arthur BALFOUR

(October 1st, 1926.)

OBSERVATIONS ON THE COAL INDUSTRY.

I. GENERAL SURVEY OF THE CONDITIONS IN THE COAL INDUSTRY.

A. THE PERIOD 1886-1914.

In order that the changes which have taken place in the coal industry since the war may be properly appreciated and placed in correct perspective, it is necessary to consider shortly the development of the coal industry in the various countries during the pre-war period.

The possession of coal deposits enabled those countries possessing them to take full advantage of the industrial changes that were brought about by the development of railways, the iron and steel industry and the steamship. In addition, the requirements of those countries which did not possess an adequate supply of coal gave rise to the development of a considerable export trade in this commodity.

The conditions under which the coal industry has developed in the various producing countries has been governed by a variety of factors, such as the suitability of the coal for various technical processes, the proximity of the coalfields to the seaboard and to deposits of other raw material for the big coal-consuming industries, and these have affected the different countries in different ways.

It may be of interest here to give the following very rough estimate which has been made of the distribution of the world's output of coal among the principal classes of consumers :

A. <i>Used as raw material.</i>	Percentage
Production of pig iron	10
Steel production	7
Gas works	5
	— —
Total used as raw material	22
B. <i>Used as fuel.</i>	Percentage
Industry (mainly for steam raising)	29
Railways	23
Electric generating stations	6
Ships' bunkers	3
Fuel for domestic purposes	17
	— —
Total used as fuel	78

In the United States of America, the coal deposits are all situated far inland (none being within 300 miles of the sea-board) and, owing to the cost of transportation, the development of the coal industry in that country has been principally dependent upon the growth of inland consumption for industrial and other purposes.

In Great Britain, on the other hand, the coalfields are situated close to convenient shipping ports and the export trade has expanded more rapidly than the inland trade.

In Germany, the principal development has taken place in the Westphalian region, where the iron and steel industry has expanded at a very rapid rate, and in Upper Silesia, which is also the seat of a considerable metallurgical industry. The greater part of Germany's export trade in coal was directed towards supplying by overland transport the needs of countries situated within comparatively short distances of her coalfield. On the North Sea and Baltic coasts lower freights for transport by sea rendered it more economical to draw the supplies for these regions from Great Britain. The dependence upon railway transport was even greater in the case of Upper Silesia than in that of the Westphalian district, which did a certain amount of seaborne trade. The principal markets for Upper Silesian coal were the eastern provinces of Germany, Poland, West Russia, Austria-Hungary and, to a much smaller extent, Scandinavia.

Output of Coal.

Appendix I shows the output of coal in the principal countries of the world in 1886 and 1913. It will be seen that during this period the world's output of coal increased from about 400 million metric tons to 1,350 million metric tons, or at the rate of 4 per cent per annum. It will be seen that the output in the United States of America increased in this period from 114 million net tons to 570 million net tons, or to exactly five times the earlier tonnage. The output in Great Britain rose in the same period from 158 million tons to 287 million tons, or by 80 per cent. The output of coal in Germany rose from 58 million metric tons to 190 million metric tons, or to three and a-quarter times the tonnage in the earlier period. It is of interest to compare with these figures particulars of the output of iron and steel in the three countries for the same period. The production of pig iron in the United States increased from $5\frac{3}{4}$ million metric tons to 31 million metric tons, that of Great Britain from 7 million metric tons to 10 million metric tons, and that of Germany (including Luxemburg) from $3\frac{1}{2}$ million metric tons to $19\frac{1}{2}$ million metric tons. Similarly, the production of steel rose from $2\frac{1}{2}$ million metric tons to 32 million metric tons in the United States, from $2\frac{1}{4}$ million metric tons to $7\frac{3}{4}$ million metric tons in Great Britain, and from $1\frac{1}{3}$ million metric tons to 19 million metric tons in Germany.

It will be convenient at this stage to consider the development of the export trade in coal of Great Britain, Germany and the United States.

Exports and Imports.

The most important exporting countries are Great Britain, Germany and the United States. In each of these countries the proportionate value of the total exports which was contributed by coal increased considerably in the thirty years before the war. Thus, for instance, in 1886 the value of coal exported from Great Britain formed 4.5 per cent of the total value of the exports of domestic merchandise, while in the year 1913 the proportion had increased to 10.5 per cent. In the case of Germany, the ratio was 2.5 per cent in 1886 and 5.6 per cent in 1913. The United States, whose coal export trade is of smaller dimensions than that of the other two countries, showed a proportion of 0.6 per cent in 1886 and 2.4 per cent in 1913.

Figures based on values, however, tend to minimise the true importance of the coal export trade in the economy of these countries.

The provision of a bulk outward cargo is of importance in cheapening the cost of transport of the homeward cargoes and thus facilitates trade generally. It is all the more important in the case of Great Britain, where the imports include not only such raw materials as cotton, wool, etc., but also grain and foodstuffs, of which she produces an insufficient supply for her needs.

The export trade is, moreover, not only of importance in itself, but also by reason of the considerable influence which it has on the inland trade; for the level of prices in the inland coal trade must follow in the long run the course of export prices.

Great Britain. — The coal export trade of Great Britain progressed steadily before the war so that, while the tonnage exported in 1886 amounted to 22 million tons, in 1913 it had attained 73 million tons. The following table shows the manner in which the exports were distributed among the various groups of destinations :

	1886 Million tons	1913 Million tons
Baltic Regions	4.2	15.9
North Sea Region	7.4	25.9
Western Mediterranean	5.1	17.2
Eastern Mediterranean	1.7	5.6
South America	1.1	6.9
North and Central America	0.8	0.2
Africa	0.4	0.7
Asia	1.4	0.8
Oceania	0.0	0.0
Other Regions	0.0	0.1
Total	22.1	73.4

It will be seen that the exports to the first four of these regions in 1913 were between three and four times those in 1886 and to South America roughly six and a-half times.

The shipments to other destinations were very small in comparison with these and were of practically the same total amount in both periods.

By far the greater proportion of the exports of coal from Great Britain consist of steam coal. In fact, nearly 75 per cent of the coal exported is steam coal, two-thirds of which is large coal. About 15 per cent of the coal exported is gas coal, principally for the Baltic Region, for Italy and for South America.

It has been estimated that approximately one-half of the coal exported from Great Britain is for the purpose of bunkering ships in other countries and at various coaling stations *en route*.

In addition to these quantities consumed outside Great Britain, there were also considerable tonnages of coal shipped as bunkers for the use of vessels engaged in foreign trade. These rose from about four million tons in 1886 to 18 million tons in 1913.

Germany. — The export coal trade of Germany was of rather a different character from that of Great Britain, inasmuch as the German coalfields are situated farther from the seaboard. Eighty per cent of Germany's export trade was with the neighbouring countries of Belgium, France, the Netherlands, Switzerland, Austria-Hungary and Russia. The exports of hard coal from Germany to these destinations in the year 1886 and in the year 1913 are given in the following statement :

German exports of coal ¹ to :	1886	1913
	Metric tons	Metric tons
Belgium	498,000	5,728,000
Denmark	5,000	221,000
France	987,000	3,243,000
Italy	42,000	895,000
Netherlands	2,962,000	7,218,000
Austria-Hungary	2,609,000	12,152,000
Russia	319,000	2,112,000
Switzerland	585,000	1,639,000
Other countries	12,000	1,390,000
Total exports	8,019,000	34,598,000

This table shows that the exports of German coal in 1913 were over four times as great as those in the year 1886, although, in point of view of the total quantity exported, the dimensions of the German trade were only about one-third of those of the British coal export trade. It should be noted that the figures given above include coal shipped as bunkers by foreign vessels.

¹ Exclusive of briquettes, coke and lignite.

Owing to the geographical situation of the collieries in Westphalia and Upper Silesia, Germany found it more economical to obtain supplies for her North Sea and Baltic coastal regions from Great Britain. Her total imports rose from 2½ million tons in 1886 to 10½ million tons in 1913, or rather more than four times the quantity in the earlier period. Of this Great Britain supplied 80 per cent in 1886 and 90 per cent in 1913. It will be observed that the exports from Great Britain to Germany increased in the period 1886 to 1913 to five times the quantity in the earlier year.

It may be of interest to mention that in the year 1913 nearly one-quarter of the coal supplies of Berlin were drawn from Great Britain.

United States of America — The export coal trade of the United States forms a much smaller proportion of the total coal trade of the country than in the case of either Great Britain or Germany. Out of a total quantity of coal of 114 million net tons raised in 1886 only 1¼ million tons were exported, or approximately 1 per cent. By 1913 the output of coal had increased to 570 million tons, of which nearly 28 million tons, or less than 5 per cent, were exported or shipped as bunkers for foreign-going vessels.

The foreign markets for American coal are principally Canada (which accounts for over 60 per cent of the exports), Central America and Brazil, while comparatively small quantities were shipped to France and Italy in 1913.

Price of Coal and Costs of Production.

Some indication of the course of prices in the various countries may be obtained from the graph in Appendix II showing the course of pit-head prices of all coal produced in Great Britain, Germany, France, Belgium and the U.S.A.

From the graph it will be seen that, from 1886 to 1913, fluctuations in pit-head prices approximately synchronised in the various coal-producing countries, but that, while they were from one and three-quarters to two and a-half times as high in the period 1909-1913 as in 1886 in Great Britain, Germany and Belgium, in France the average 1909-1913 pit-head price was only 40 per cent above that of 1886, and in the United States the pit-head price of bituminous coal only showed an increase of 8 per cent. The actual figures for the two periods are given in the table below :

Country.	Average value per ton raised.		
	1886 Shillings	1909-1913 Shillings	1909-1913 as percentage of 1886
Great Britain	4.9	8.7	177.5
Germany, Ruhr (Dortmund)	4.6	10.8	234.8
Upper Silesia (Breslau)	4.2	8.9	211.9
Belgium	6.7	12.8	188.2
France	9.1	12.7	139.6
U.S.A. (bituminous coal)	4.9	5.3	108.2

Transport Charges.

It is difficult to summarise the position in respect of charges for the inland transport of coal in the various coal-producing countries in such a way as to give results of any value, but the following particulars relating to the year 1913 are of interest :

Route	Approximate distance in miles	Estimated average rate per ton.
		<i>s. d.</i>
Ruhr-Rotterdam (rail and barge)	140	2 10
Pit to Port, U.K.	25	1 11
Pit to Port, U.S.A. (West Virginia to Hampton Roads)	310	5 0

Railway Statistics, 1913.

Country	Approximate average length of haul.	Estimated average charge per ton.
		<i>s. d.</i>
Great Britain	45 miles	2 0
Germany	80 miles	3 6

The course of ocean coal freights is an important matter from the point of view of the British coal export trade. A comparison of some of the more important rates in the year 1888 and the year 1914 is given below :

	1888	1914
	<i>s. d.</i>	<i>s. d.</i>
Cardiff - Rouen	7 0	6 3¼
„ Bilbao	5 3	5 4¾
„ Havre	5 8	5 1½
„ Genoa	10 0	8 10½
„ Rio	29 9	14 1½
	1888	1913
Tyne - Hamburg	4 9½	3 9¼
„ Copenhagen	5 5¾	5 6¼
„ Stockholm	6 0	5 2¼
„ Stettin	5 1	5 5¾
„ Kronstadt	4 8	5 7

B. THE POST-WAR PERIOD.

In order to arrive at a proper understanding of the coal position throughout the world in the post-war period, it is necessary to examine separately the position of each of the principal coal-producing countries, since there are wide differences in the character of the problems which each has had to face, arising from correspondingly wide differences both in the conditions affecting production and in the nature of the markets for which they cater.

It will, however, be helpful in the first place to consider broadly the whole world's position with the help of statistics relating to the total production of coal, the general level of coal prices, etc., immediately prior to the war and in the period of seven years which has elapsed since its termination.

Coal Production.

The outstanding fact which emerges from a consideration of the output figures is that in 1925 the world's output of coal (including brown coal reckoned at its equivalent in terms of black coal : 3 tons brown coal = 1 ton black coal)¹ amounted to 1,245 million metric tons as compared with 1,258 million tons in 1913, a reduction of only one per cent from the highest point which the world's coal production has ever reached.

Although the 1913 output figure of 1,258 million tons was, as has been stated, the highest ever reached and represented an increase of 10.7 per cent over the average for the five years 1909-13, it would be fallacious to assume from the comparison of 1909-13, as is sometimes done, that the 1913 figure was abnormally high. The fact is that the years 1911 to 1912 were years of relatively low production, and it will be seen from the curve shown in Appendix III to this introductory note portraying the growth in the world's output of coal from 1890 to 1913 that the 1913 figure was in no way abnormal.

Reference has been made to the problems which the coal industry in the principal coal-producing countries has had to face in recent years. In the three principal producing countries, viz., the United States of America, Great Britain and Germany, the most important of these problems has been that of lack of demand, but it will be seen from the figures quoted above as measuring the world's consumption of coal in 1913 and 1925 that the problem was not due to any appreciable extent to a reduction in the total world demand for coal as compared with the pre-war demand.

The problem was indeed different in each of these three cases and may be stated briefly as follows :

United States of America. — In the United States the problem is not a new one, for even before the war colliery development had proceeded very far in advance of the maximum internal demand, and, owing to their geographical position, most of the coalfields in the United States can only cater for the inland

¹ In the Memorandum prepared in the Secretariat, Coal and lignite equivalents were calculated in the ratio 2 : 9, which explains certain differences in the results obtained (Note by the Secretariat).

market. The problem has been intensified owing to the further rapid development of coal production which took place to meet the abnormal internal demand of the war period. It is true that those of the American coal-fields which are suitably placed for competing in the world's markets (*e.g.* the Mediterranean and South America) have endeavoured to secure a larger share in this trade, but though this has had a sensible effect on the position of other exporting countries, such as Great Britain, the tonnage involved is insignificant in relation to the output of the United States. On the other hand, Canada, which prior to the war imported practically no coal from anywhere other than the United States, has recently begun to import anthracite from South Wales, which has displaced supplies from Pennsylvania.

Great Britain. — The position in Great Britain differs in two essential respects from that of the United States of America. In the first place, there was before the war no abnormal margin between output and demand, such as existed in the United States. In the second place, about one-third of the output of Great Britain was produced either for export or for shipment for bunkering purposes.

It will be seen from the following figures that the difficulties of the British coal trade in 1925 were due in the main to the displacement of British coal by coals produced abroad rather than to a reduction in the total demand for coal :

	(a)	(b)	(c)	(d)
	British output.	British coal exports.	World consumption outside Great Britain.	(b) as percentage of (c)
			(Million metric tons.)	
1913	292.0	74.6	1,041.0	7.2
1925	248.4	49.4	1,046.3	4.7

The reasons for this displacement of British coal by other coals in the markets of the world will be analysed in detail later, but it may be stated briefly here that the main reason is the much greater increase in the costs of production of British coals owing to increased wages and shorter hours of work than in the cost of production in other countries. A secondary reason is to be found in the effects of the war in : (a) stimulated production of coal in countries like Holland and Spain, which had relied largely on imported coals before the war, and (b) import restrictions imposed as in Germany and Spain for the purpose of securing markets for home-produced coals.

Germany. — In Germany the position is that the output capacity of both the black and brown coal-mines has been increased very largely during the post-war period. The excess of exports from over imports into pre-war German territory in 1925 (including deliveries of reparation coal) was 30 million metric tons in 1925 as compared with 24 million metric tons in 1913 — an increase of

6 million tons per annum as compared with a decrease of 25 million tons per annum in the exports from Great Britain.¹

Having regard to the increase in the world's population since 1913, it would have been natural to expect at least a corresponding increase in coal consumption. Three main features have contributed to prevent this :

- (a) The hampering effect of the disturbed political, economic and financial conditions resulting from the war which still remain.
- (b) The substitution of hydro-electric power and oil for coal.
- (c) The impetus which the shortage of coal during the war gave to the discovery of methods for securing economies in the use of coal.

The first of these is clearly transient in character.

As regards the rapid development of hydro-electric power in recent years, which, like the stimulation of the coal output in coal-importing countries, was due to the "national security" policy fostered by the war, it may be said that this has now almost reached its limit. Further than this, the position in Italy, where a large increase in the production of hydro-electric power has been accompanied by an increase in coal consumption, illustrates the point that to a material extent the provision of power in this way itself tends to stimulate industrial activity and coal consumption.

As regards oil, the potentialities here, too, are definitely limited. The substitution took place principally in the case of ships' bunkers, and of late the fall in the general level of coal prices has tended towards a reversion from oil to coal, a process which is likely to be carried further as a result of technical improvements in marine steam-engine design.

So far as further progress in economies in methods of coal consumption are concerned, there is no reason to suppose that, as in the past, these will not be consistent with, and, indeed, themselves productive of, a growing increase in demand.

The general conclusion to be deduced from the foregoing is that an examination of the world's position in regard to output and demand affords no justification for any proposals for artificially restricting the normal development of coal production. It may safely be stated that, if the artificial hindrances to industrial activity above referred to were removed, the world's output of coal (save as regards the special case of the United States of America, which is a self-contained problem) would be inadequate to cope with the demand, and the direction which efforts to improve the world's coal position should take should be in the direction of removing the obstacles in the way of the revival of industrial activity and the free interchange of commodities, rather than in the direction of endeavouring to regulate and restrict the output of the basal commodity on which the industrial activity of the world depends.

¹ The figure of 30 million metric tons is arrived at by taking the combined export figures of those territories which formed part of the German Empire in 1913 and deducting the tonnages passing over frontiers which in 1913 were situated in the interior of Germany. This procedure enables one to arrive at a comparable figure with that of 1913 for the German Empire.

Exports and Imports.

The course of the export coal trade since 1918 has been marked by very severe fluctuations traceable to the direct and indirect effects of the war on production and on demand. The position continued to be governed by these abnormal circumstances until after the restoration of the output of coal in Germany on the termination of the occupation of the Ruhr by the Allies, that is to say up to the early part of 1924. In view of the transient character of the influences at work, it is hardly worth while examining the position in detail during the period 1919-24, but it will suffice to consider the situation since 1924 in comparison with that existing immediately prior to the war.

Great Britain. — It has already been mentioned that the exports from Great Britain in 1925 were less by 25 million tons than in 1913, and it is therefore of interest to examine the markets in which Great Britain has lost ground in 1925. The following table compares the exports in the year 1913 and the year 1925, distinguishing the principal regions to which British coal was exported :

Destination	Exports in 1913.	Exports in 1926.
Baltic Region	15.9	8.2
North Sea Region	25.9	18.7
Western Mediterranean	17.2	11.6
Eastern Mediterranean	5.6	2.9
Africa	0.7	0.5
Asia	0.8	0.6
Australasia	0.0	0.0
North and Central America	0.2	1.0
South America	6.9	4.5
Other Regions	0.1	0.2 ¹
Total	73.4	48.3 ¹

From this table it will be seen that the shipments to the Baltic have been reduced to almost one-half of the pre-war quantity; that the North Sea shipments have been reduced by 25 per cent; that the quantities consigned to the Western Mediterranean have been reduced by one-third; that those to the Eastern Mediterranean have been reduced by nearly one-half; and the shipments to South America by rather more than one-third. In the Baltic Region the biggest loss was in respect of shipments to Russia and the Succession States, which accounted for over 60 per cent of the decreased shipments to this area, though there were also significant decreases in the shipments to Sweden, Norway and, to a lesser extent, Denmark. The loss in trade in the North Sea Region is principally to be attributed to decreased quantity of coal taken by Germany, whose supplies from Great Britain in 1925 were less than one-half of those in

¹ Excluding shipments to Irish Free State.

1913, but the French and Dutch imports from Great Britain also decreased by more than 25 per cent, an increase on the other hand being recorded in the case of shipments to Belgium.

In the Western Mediterranean Region the exports of coal to Spain decreased by more than 50 per cent; those to Portugal by 40 per cent; and those to Italy by 30 per cent. In the Eastern Mediterranean Region the principal decreases were in shipments to Egypt and Austria-Hungary, while Greece, Roumania and Turkey also took decreased quantities. As regards South America, the decreases in shipments to Brazil, the Argentine, Uruguay and Chile were respectively 22, 30, over 50, and 90 per cent.

The fact that, as already stated, reductions in exports of British coal were due not so much to reductions in consumption of coal but to the displacement of British by other coals is illustrated by the following table:

COMPARATIVE STATEMENT OF THE IMPORTS OF COAL¹ FROM GREAT BRITAIN IN RELATION TO THE TOTAL CONSUMPTION OF COAL IN THE PRINCIPAL COUNTRIES CONSUMING BRITISH COAL.

(Figures in 1,000 metric tons.)

Country	1913			1925		
	Consumption of coal	Imports of coal from Great Britain	Percentage of consumption supplied by Great Britain	Consumption of coal	Imports of coal from Great Britain	Percentage of consumption supplied by Great Britain
Russia and Succession States	45,601	4,400	9.65	—	—	—
Norway	2,658	2,469	92.89	2,599	2,212 ³	85.11
Sweden	5,929	5,090	85.86	4,700	3,519	74.87
Denmark	3,603	3,297	91.50	4,290	3,785	88.22
Netherlands	9,956	2,039	20.50	11,679	1,356	11.61
Germany	176,700	9,239	5.23	152,417 ⁴	3,507 ⁴	2.30
France	63,522	11,427	17.99	76,477	10,103	13.21
Belgium	26,565	2,280	8.58	30,696	2,284	7.44
Italy	10,947	9,393	85.80	11,769	6,734	57.21
Spain	7,176	2,983	41.57	7,183	2,081 ³	28.97
Portugal	1,419	1,406	99.08	920 ⁶	872 ³	94.78
Egypt	1,721	1,549	90.00	1,322	1,227	92.81
Algeria	2,251	1,305	57.97	1,455 ⁶	1,278 ³	87.83
Chile	1,872	603	32.25	679 ⁶	138 ⁶	20.32
Brazil	2,287	1,922	84.04	1,909 ⁷	1,312 ³	68.72
Argentine	4,045	3,762	93.00	3,200	2,706 ³	84.56

¹ Including coal equivalent of coke and briquettes.

² Not available.

³ British export figures.

⁴ Post-war Germany, which includes those parts of the former German Empire which consumed British coal.

⁵ Total of British and German exports.

⁶ Particulars for 1924, the last year available.

⁷ Total of British and American exports.

Germany. — In the case of Germany, account must be taken of the changed frontiers in 1925 as compared with 1913, and also of supplies on account of reparations. Exports from the Ruhr in 1913, including the coal equivalent of coke and briquettes, amounted to 24 $\frac{1}{4}$ million metric tons, while in 1925 14 $\frac{1}{2}$ million tons were exported in the ordinary way and 13 $\frac{1}{2}$ million tons as reparations, making a total of nearly 28 million tons. This is an increase of 13 per cent on the 1913 figure, as contrasted with the reduction of 33 per cent in the case of Great Britain.

Comparing the exports to the various destinations from pre-war Germany, *i. e.*, present Germany together with Polish Upper Silesia, the Saar and Alsace-Lorraine, in 1925 with those in 1913 and including deliveries on reparations account, it is found that, to France, Germany supplied more than double the pre-war quantity of coal and to Italy over two and a-half times the pre-war quantity. To Belgium there was a reduction of one-third, to the Netherlands a reduction of 7 per cent, to Austria a reduction of 60 per cent, and to Russia a reduction of 90 cent.

United States of America. — The exports from the United States of America amounted to 21 million tons in 1913 and to 15.5 million tons in 1925, but the quantities exported to France and Italy increased from 16,000 and 332,000 tons in the earlier period to 234,000 and 778,000 tons respectively. Exports to Canada fell from 16 $\frac{1}{2}$ million tons to approximately 12 million tons. The quantity exported to Mexico fell from 454,000 tons to 112,000 tons and the quantity supplied to Cuba from 1,316,000 tons to 620,000 tons. The quantity supplied to the Argentine increased from 39,000 tons to 147,000 tons, and that to Brazil from 236,000 tons to 587,000 tons; while Chilean imports from the United States decreased from 112,000 tons to 24,000 tons.

In addition to the above quantities of coal exported, the United States shipped as bunkers, in the year 1913, 7,350,000 tons and, in the year 1925, 4,344,000 tons.

Coal Prices.

In examining the course of coal prices during the post-war period, it will be instructive to compare the average realised price per ton at the pit-head in each country in the post-war period with the corresponding average price over the period of five years 1909-13, and also to compare the increases in the coal prices thus revealed with the increases in general commodity prices as shown in the index number of wholesale prices compiled by the British Board of Trade and similar authoritative index numbers of wholesale prices.

These comparisons are set out in Appendices IV and V to this note. It would be fallacious to take the year 1913 as a pre-war basis of comparison, because there was a sharp rise of coal prices at that time which set them for the time being out of normal relationship with general commodity prices.

The coal price levels of the years 1920-23 were so much affected by a series of abnormal circumstances directly or indirectly due to the war that they have

no practical significance for present purposes, except in so far as they bear upon the point already alluded to, that scarcity and high coal prices stimulated the production of coal in certain coal-importing countries and also encouraged resort to substitutes.

Examples of the abnormal circumstances in question are : the cessation of abnormal war-time industrial activity in the United States at the end of 1918, which was reflected in depressed conditions in the coal industry, and a low level of coal prices ; the maintenance of Government control in the coal-mining industry in Great Britain up to the end of March 1921 ; the three-months stoppage of work in British coal-mines from the beginning of April to the end of June 1921, the combined effect of which was a diminished output of British coal up to the end of 1921 and a relatively high price level ; the military occupation of the Ruhr in 1923 which involved severe reductions in the German output ; and an increase in the world level of coal prices.

It may be said that, while there was a continuous fall in the average pit price of coal in all the principal countries, save the United States of America, from 1923 to the end of 1925, corresponding more or less with the reduction which took place in general commodity prices, yet the average pit price of coal remains throughout at a slightly higher level relative to that of the quinquennium 1909-13 than in the case of general commodity prices.

Transport Charges.

When considering the level of coal prices as affecting the consumer, it is necessary to take into account the cost of transport, which forms an important part of the delivered price of a commodity such as coal which is bulky in relation to its value. Here it is difficult to generalise, at any rate so far as the cost of inland transport is concerned, but the following figures give the average percentage increase in railway rates per ton of coal carried in the various countries in 1925 as compared with 1913 :

	Per cent
United States of America	110
Great Britain	83
Germany	41
France	—
Belgium	—

So far as sea freights on coal are concerned, these have remained throughout the period under consideration (1923-25) at or about the level which obtained immediately before the war. The following examples may be cited :

	1914	1923	1924	1925
	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
Cardiff - Rouen	6 3¼	6 9¾	5 3	4 7½
„ Bilbao	5 4¾	7 10¼	9 0	7 6
„ Havre	5 1½	6 7½	5 0	4 2¼
„ Genoa	8 10½	11 7½	10 4½	8 8¼
„ Rio	14 1½	16 0	13 4½	15 3¾
	1913	1923	1924	1925
	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>	<i>s. d.</i>
Tyne - Hamburg	3 9¼	5 7	4 5½	4 0
„ Copenhagen	5 6¼	6 10	6 1	6 3½
„ Stockholm	5 2¼	7 1	5 11¼	5 2
„ Stettin	5 5¾	6 9½	6 8½	5 6¾
„ Kronstadt	5 7	10 7	—	—

II. THE ORGANISATION OF THE COAL INDUSTRY IN GREAT BRITAIN.

There exists in each of the coalfields of Great Britain, except the Kent coalfield, a district colliery owners' association. There are in all twenty-five of those associations and all of them, except that in the small Cumberland coalfield, are members of a Federation of district associations known as the Mining Association of Great Britain. The functions of the Mining Association of Great Britain are generally to watch and to take action on behalf of its members in connection with all matters affecting, or which may be likely to affect, its members or the coal-mining industry, particularly matters which may be the subject of action by the State.

So far as the regulation of wages and conditions of work of mine workers are concerned, the Mining Association cannot take action affecting any district without the express consent of the district association. In 1921 the Mining Association was authorised by the district associations to make a national agreement with the Miners' Federation of Great Britain (which is a federation of district miners' associations), laying down uniform principles for the determination of wages in each of the areas which under the agreement constituted a unit for the purpose of periodical wages ascertainment. This was the first occasion on which a national agreement had been made, wages questions having been the concern of district associations exclusively prior to the war. At the moment of writing, the general stoppage of work in the coal-mines of Great Britain still continues. The colliery owners have intimated

that, in their view, national wage arrangements have been disastrous in their results and have proved quite impracticable and that they must insist on the regulation of wages in future on the basis of purely district agreements negotiated between the associations of employers and workmen in the different coalfields.

The Mining Association possesses no power to deal with coal prices or the distribution of orders. Commercial matters of this kind are the concern of the individual colliery undertakings.

III. STATISTICAL APPENDICES.

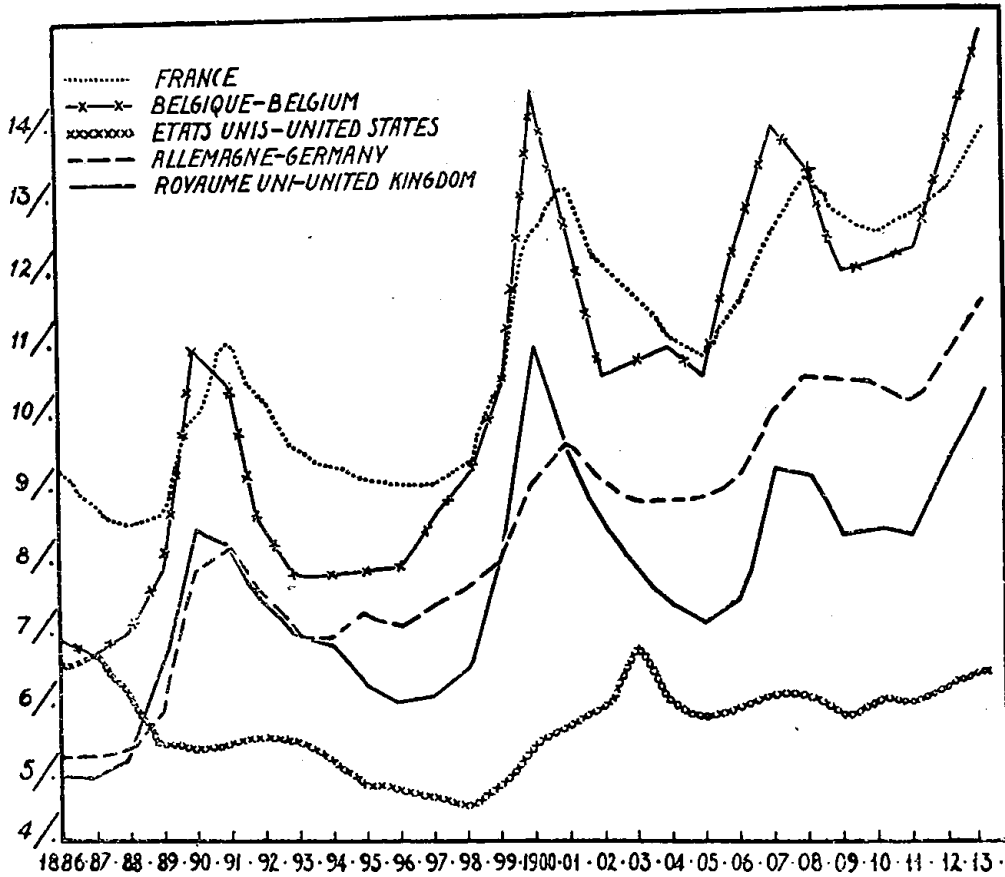
Appendix I.

WORLD PRODUCTION OF COAL AND LIGNITE IN 1886 AND 1913.

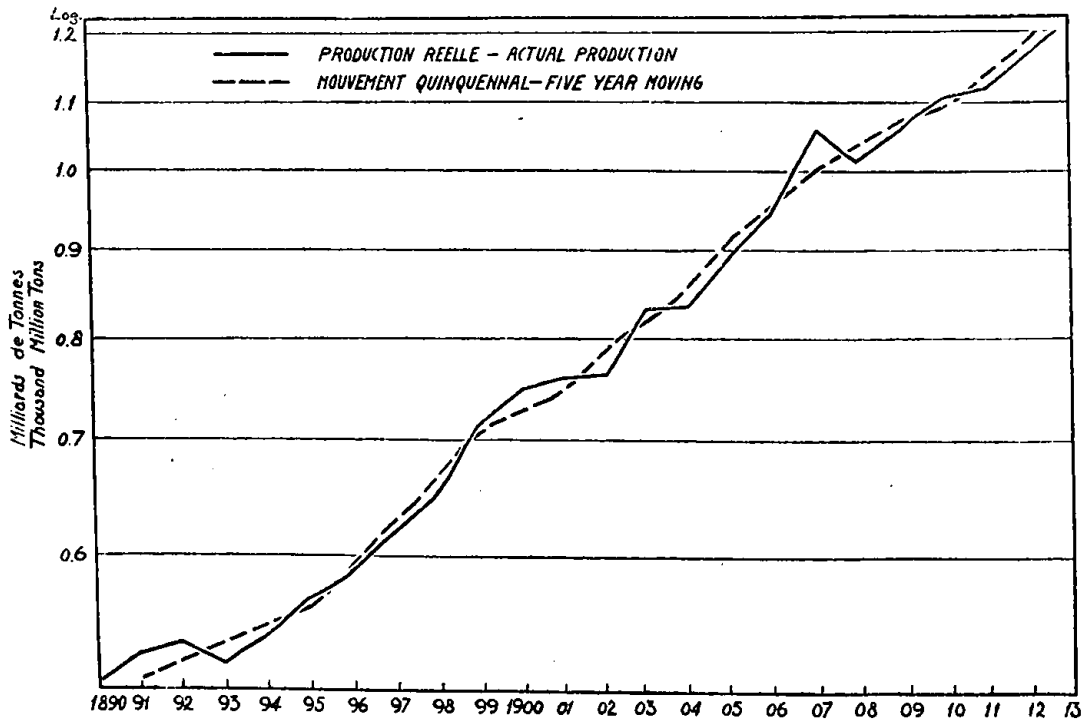
		1886	1913
		Million tons of 2,240 lb.	
<i>Europe.</i>			
Great Britain		157.5	287.4
Germany	Coal	72.5	188.4
	Lignite		85.8
France	Coal	19.6	39.4
	Lignite		0.8
Austria-Hungary	Coal	20.4	17.5
	Lignite		35.7
Belgium		17.0	22.5
Russia		4.5	31.7
Spain		1.0	4.2
Holland		—	1.8
Other countries	Coal	0.4	1.1
	Lignite		1.8
<hr/>			
Total Europe	Coal	292.9	594.0
	Lignite		124.1
<hr/>			
<i>Asia.</i>			
India		1.4	16.2
Japan		1.4	21.0
China		—	13.6
Other countries		—	3.7
<hr/>			
Total Asia		2.8	54.5

	1886	1913
	Million tons of 2,240 lb.	
<i>America</i>		
United States	101.5	508.9
Canada	1.9	13.4
Other countries	—	1.5
Total America	103.4	523.8
<i>Africa</i>		
Union of South Africa	0.0	9.6
Rhodesia	—	0.2
Total Africa	0.0	9.8
<i>Australia</i>		
New South Wales	2.8	} 12.4
Queensland	0.2	
Victoria	—	
West Australia	—	
New Zealand	0.5	1.9
Total Australia	3.5	14.3
TOTAL FOR WORLD	402.6	1,320.5

Appendix II. — AVERAGE PIT-HEAD PRICE PER TON RAISED
IN VARIOUS COUNTRIES (1886-1913).



Appendix III. — WORLD OUTPUT OF COAL (1890-1913).



Appendix IV.

AVERAGE VALUE PER TON RAISED AT PIT.

Period	United States (Bituminous)		Great Britain		Ruhr		France		Belgium	
	<i>s.</i>	<i>d.</i>	<i>s.</i>	<i>d.</i>	<i>s.</i>	<i>d.</i>	<i>s.</i>	<i>d.</i>	<i>s.</i>	<i>d.</i>
1909-13	5	3½	8	9	10	9½	12	8½	12	10
1913	5	6	10	1½	11	9½	13	6¼	14	11
1919	12	7	27	4	11	9½	35	11	38	2½
1920	22	11	34	7	13	7	32	0	34	3½
1921	16	9½	26	2¼	10	5	32	11¼	33	8¼
1922	15	3½	17	7½	—	—	28	2	27	1¼
1923	13	1	18	9¾	—	—	—	—	24	8¾
1924	11	1	18	10	20	1	—	—	—	—
1925	—	—	16	6	—	—	—	—	—	—

Appendix V.

COMPARISON OF INDEX NUMBERS OF COAL PRICES AND INDEX NUMBERS OF WHOLESALE PRICES.

Average Value per Ton raised as Percentage of Value in 1909-13. *Index Number of Wholesale Prices*

Period	United States (Bituminous)		Great Britain	Ruhr	France	Belgium	Index Number of Wholesale Prices	
							Great Britain	U.S.A.
1909-13	100	100	100	100	100	100	100	
1913	103.9	115.7	109.3	106.4	116.2	105	101	
1919	237.8	312.4	109.3	282.6	297.7	268	208	
1920	433.1	395.2	125.9	251.8	267.2	323	228	
1921	317.3	299.3	96.5	259.2	262.5	207	148	
1922	289.0	201.4	—	221.6	211.2	167	150	
1923	247.2	215.0	—	—	192.7	167	155	
1924	209.4	215.2	186.1	—	—	175	151	
1925	—	188.6	—	—	—	173	160	

NOTE ON THE COAL INDUSTRY IN GERMANY

**Extract from a Memorandum prepared by the
FACHGRUPPE BERGBAU DES REICHSVORBANDES DER DEUTSCHEN INDUSTRIE,**

Communicated by Dr. C. LAMMERS.

(October 23rd, 1926)

NOTE ON THE COAL INDUSTRY IN GERMANY.

I. GENERAL SITUATION OF THE GERMAN MINES.

The German coal-mining industry includes the extraction of lignite and hard coal. Lignite has a higher moisture content and an inferior calorific value as compared with hard coal. Official statistics take nine tons of German lignite as equivalent on the average to two tons of German hard coal.

In 1913, the German coal-mining industry reached its maximum development up to that time with an output of 190.1 million tons of hard coal, equivalent to 15.62 per cent of world output. In the same year 87.2 million tons of lignite were raised. Since 1885, in one generation, Germany had succeeded in increasing her hard-coal production nearly three and a-half times and her lignite production nearly six times. Stated in terms of hard coal, the total production of the German mines in 1913 was about 209.5 million tons. In the same year imports amounted to 16.1 million tons, exports to 46.1 million tons ; the excess of exports over imports, therefore, was 30 million tons and consumption 179.5 million tons. Thus Germany's requirements in coal were assured from her own production even in periods of large demand. Lignite-mining was less affected by the war than the hard-coal industry. The lignite mines, which in Germany are worked to the extent of 80 per cent above ground and for the most part by machinery, can meet its requirements with unskilled labour more easily than the hard-coal industry ; consequently, it was in a better position than the latter to replace the labour withdrawn from it by the war. The output of hard coal could not be maintained during the war at the level reached in 1913 ; in 1917, (the last year but one of the war), output amounted to 167.7 million tons. The output of lignite, however, in 1917 exceeded the 1913 figure and amounted to 95.5 million tons.

At the end of the war, Germany immediately lost the coal areas in Lorraine, with a production of 3.8 million tons (1913) and in the Saar area, with a production of 13.2 million tons (1913).

To these losses must be added the difficulties caused by events in Upper Silesia, where, in 1913, output had amounted to 43.4 million tons. With the partition of Upper Silesia, coal-mines with an output of 32.3 million tons (1913) fell to the share of Polish Upper Silesia. Compared with 1913, therefore, Germany's total losses amounted to approximately 26 per cent of the pre-war production.

In virtue of the German-Polish Agreement of May 15th, 1922, Germany had for some time to deliver to Poland large quantities of coal (*e.g.* 10,000 tons per month in 1922); on the other hand, she was compelled at other times to accept delivery of still larger amounts of Polish coal (500,000 tons per month in 1924).

These variations rendered the shaping of the economic policy of the German coal industry extremely difficult.

Similarly, the deliveries under the heading of reparations had important consequences. In 1913 Germany had supplied the following quantities of fuel (expressed in terms of hard coal):

	Million tons
France	6.8
Belgium	7.5
Italy	1.3
Luxemburg	4.-
Alsace-Lorraine	6.9
Total	26.5

Almost the same quantity was delivered under the heading of reparations, although the total German output of coal had greatly diminished.

As a result of the shortage of coal due to the general situation, Germany imported monthly during the second half-year of 1922 1.94 million tons of coal (expressed in terms of hard coal), which corresponded almost exactly to the amount of reparations deliveries. With a view to improving the situation, the German mines were compelled to increase their output by all possible means, at the cost of postponing necessary measures of rationalisation.

In 1924, the situation in the international coal market underwent a change. The reparations demands for coal became more irregular, both as regards quality and quantity. Thus, for example, deliveries of coke amounted:

In 1920 to	4,538,000 tons
In 1922 to	6,524,000 „
In 1924 to	3,700,000 „ (about)

In 1926, Belgium cancelled the whole of her demands as from November 1st. At a time of coal shortage, the irregularity of the demands for reparations deliveries had a very marked effect on the German ironworks, whose output programme was substantially reduced. This resulted in heavy imports of iron and metallurgical products. Now that there is no longer a dearth of coal, fluctuations in reparations deliveries primarily affect the German coal industry and are prejudicial to any continuous policy.

During the occupation of the Ruhr, the output of coal in that area fell from a monthly average of 8 million tons in 1922 to 2.1 million tons in June 1923 and to a still lower figure in the following months. In consequence, the total imports of coal into Germany rose in 1923 to 26 million tons (all kinds of fuel being expressed in terms of hard coal). When the "struggle in the Ruhr" came to an end, heavy burdens were imposed upon the mines by the M. I. C. U. M. agreements. Production only very gradually returned to something like the normal. The output figures for 1922 were again reached in March 1924, the miners having agreed to work an extra hour in all the coal areas as from January 1st, 1924. The financial effects of the general situation in Germany (currency disturbances and fluctuations in production) continued to be felt for a long time throughout the whole of the mining industry, and particularly in the Ruhr.

The burden of State and communal taxation, which, before the war, amounted to about 0.25 marks per ton in the principal mining districts, rose in 1925 to amounts varying, according to the local rates, between 1 mark and 1.30 marks. To these burdens must be added the charge due to increased transport rates. Between 60 and 70 per cent of Ruhr coal, between 82 and 90 per cent of coal from other areas, and 89 per cent of briquettes are carried by rail. Compared with 1913, the average increase in transport rates for all distances amounts at the present time to 42 per cent. Further, it has not been possible fully to restore the special rates formerly accorded to the export trade. Finally, account must be taken of the increased cost of mining material due to the rise in transport rates.

The internal German demand was largely reduced by the cession of territory, Reparations deliveries to certain areas formerly included in the German Customs union only partly compensate the losses sustained. Export business also encounters many difficulties. The creation of new States, some of which are surrounded by very high Customs barriers, the restrictions and prohibitions on imports, the endeavours of many countries to make themselves as far as possible economically independent, constitute so many obstacles to normal marketing. Thus, in 1913, pre-war Austria (without Galicia) took about 11.6 million tons from Germany; in 1925, Germany exported to Austria only 1.8 million tons, and Eastern Upper Silesia 3.6 million tons, making a total of 5.4 million tons. Export to Russia (without Poland), which in 1913 took 1.7 million tons from Germany, has ceased. The same applies to the 3.5 million tons formerly taken by pre-war Poland, including Galicia. The export trade also suffers from the fact that during and since the war many European countries have begun to make more extensive use of hydraulic power.

II. INTERNAL DEVELOPMENT OF THE GERMAN COAL INDUSTRY.

After the war the length of the working day was reduced in comparison with pre-war days throughout all German coal-mines. In order to make up for the diminished output, resort was had to a large increase of personnel.

Thus, for example, the Ruhr area (excluding subsidiary enterprises) employed :

1913	372,000 workers	1921	542,000 workers
1920	470,000 „	1922	552,000 „

In spite of this increase, it was found impossible to attain at once the pre-war output per working day.

Taking the Ruhr area as an example, output amounted :

In 1913	to an average of	378,000 tons	
„ 1920	„ „ „ „	291,000 tons	= 76.9%
„ 1921	„ „ „ „	310,600 tons	= 82%
„ 1922	„ „ „ „	347,000 tons	= 91.8%

On January 1st, 1924, the eight-hour day was introduced. Since that date the rate of output per worker has steadily increased and, in almost all German coal-mines, now exceeds the pre-war figures. The rate per worker and per day of work for the whole of the personnel is as follows :

<i>Area</i>	1913	1924	1925	First quarter of 1926
	In kilos.	In kilos.	In kilos.	In kilos.
Ruhr	943	857	946	1,065
Western Upper Silesia	1,139	933	1,154	1,239
Lower Silesia	669	556	662	719
Aix-la-Chapelle	768	609	709	776
Saxony	709	472	560	592

This increase of output is not due solely to the longer working day and to the increased output by the miners but also to the important results obtained from the rationalisation of the mining industry and the development of mechanical resources, which, pushed forward with the utmost energy from 1924 onwards, became fully effective in 1925 and 1926. Below are given a few figures regarding the development of mechanical resources in the Ruhr area ; it should be noted that the irregular geological formation of this area confines the use of mechanical resources within much narrower limits than, for example, is the case in England or, still more, in America.

The following machinery was in use on the dates mentioned :

	December 31st, 1913	December 31st, 1925
Hammer drills	10,141	31,516
Spiral drills	32	2,260
Pneumatic percussion picks	189	35,666
(a) Light model of about 6 kg. maximum weight	29	21,249
(b) Heavy model of about 6 kg. minimum weight	160	14,417
Coal-cutters	—	316
Large coal-cutting machines	13	522
(a) Light model of 1,800 kg. maximum weight	—	82
(b) Heavy model of 1,800 kg. minimum weight	13	440
Coal-cutting machines (bar type)	231	748
"Shaker" conveyors	1,672	6,195
Length of conveyors (in meters)	104,842	361,954

In the Ruhr mines more coal is now extracted by mechanical means than by manual labour. At the present time, only 49.6 per cent of the output is obtained by hand labour with blasting, while in 1913 only 5 per cent was obtained by mechanical means with blasting.

In pursuance of its programme of rationalisation, the Ruhr mining industry closed down a large number of unremunerative mines ; in the year 1924-25, 77 undertakings normally employing 60,000 workers were closed down. Moreover, in order to reduce the costs of production to a competitive level, a large number of less productive seams were closed. Most of these mines and seams will never be worked again. The Ruhr area has had to shoulder the enormous loss of capital involved by this measure in order to preserve its competitive power and thereby its very existence.

The situation is very similar in nearly all the German coal areas. The following figures show the transition from purely manual labour to machine labour in the German Upper Silesian area :

	1913	1925
Horses	420	127
Funicular railways :		
Compressed air	14	79
Electric	18	93
Locomotives :		
Benzol-driven	83	113
Electric	29	89

	1913	1925
"Shaker" conveyors :		
Compressed air	118	407
Electric	—	41
Length of conveyors (in meters)	1,580	23,288
Extractor windlasses :		
Compressed air	100	1,266
Electric	37	186
Hand drills :		
Compressed air	1,101	3,079
Electric	76	471
Percussion picks	6	697
Cutting machines	14	299
Ventilators (of galleries) :		
Compressed air	20	242
Electric	17	76
Pumps for preliminary work and excavation	92	317
Excavating machines :		
Number	42	54
Capacity in tons per hour	4,833	6,803
Compressors :		
Number	33	53
Capacity (in cubic meters of air evacuated per hour)	126,800	330,680
Discharging apparatus at the shaft	11	31

In the Lower Silesian hard-coal area the hand-worked spiral drill formerly customary in extracting coal has almost entirely disappeared, and has been replaced by hammer drills and percussion picks driven by compressed air. In 1925 there were in use in Lower Silesia about 2,700 hammer drills. "Shaker" conveyors worked by compressed air or electricity have been installed in large numbers. In 1925 there were 36,000 of these machines in use. The use of electrically-driven excavating machines for deep-level mining is very widespread.

Owing to the extreme difficulties experienced by the German mining industry in finding markets since the middle of 1924, especially in 1925 and in 1926 up to the beginning of the British coal dispute — difficulties which necessitated dismissals on a large scale, reduction in the number of shifts worked, and the accumulation of enormous stocks — the increased output per miner and per shift

has not yet been reflected in a corresponding increase in the total output figure. In 1925 the total output of coal, namely, 132.7 million tons, was still 8.1 million tons, or 6 per cent, below the 1913 total. This decrease is almost exclusively to the account of the Ruhr area, where output, which in 1913 amounted to about 114.2 million tons, did not exceed 104.1 million tons in 1925. Apart from the Ruhr area, Saxony is the only district where the output in 1925 was less than that of 1913 (3.9 million tons, as compared with 5.4 millions). The other coal areas exceeded the pre-war output in 1925 ; Lower Silesia produced 5.6 million tons, as against 5.5 millions in 1913 ; Aix-la-Chapelle produced 3.5 million tons, compared with 3.3 millions. The increase is very marked in German Upper Silesia, where output rose from 11.1 million tons in 1913 to 14.3 millions in 1925. The daily output rose from 36,800 tons to 60,000 tons by the end of 1925, which has enabled this area to make good the whole loss of Polish coal.

Owing to the great diminution in German iron production, the coke industry is in a very unfavourable position. Output amounted in 1913 within the present German frontiers to 31.7 million tons ; in 1925, it did not exceed 26.8 million tons ; there is, therefore, a reduction of nearly 16 per cent.

The coal industry has frequently suffered from sharp disputes regarding wages and scales of payment, as well as from numerous interruptions of work due to unrest and strikes.

III. SURVEY OF THE FUTURE DEVELOPMENT OF THE GERMAN COAL-MINING INDUSTRY.

The restriction on coal imports will have to be maintained until the German coal industry has recovered from the heavy losses which it has suffered in the last few years through the liquidation of the war, with its effects on domestic and foreign trade, the period of inflation, the occupation of the Ruhr, etc. The unrest in the years immediately following upon the war and the reduction of the working day to seven hours have seriously hindered its development. The loss of more than a quarter of the German coal output and the obligation to deliver large quantities of coal by way of reparations created for some years an acute coal shortage in Germany, so that the mining industry had to turn its whole energy to the enhancement of production and was obliged to postpone urgently needed measures for the rationalisation and modernisation of undertakings much exhausted by the war. In this matter it was further hindered by the enormous capital and current losses resulting from inflation and the occupation of the Ruhr. Since the return to more orderly conditions, the industry has approached the work of rationalisation with the utmost energy and with the use of all the resources available. As has been shown in the previous chapter, much has already been done, but in the execution of the measures which still remain to be carried out, the industry is seriously hampered by the imposition of very high charges in taxes and transport rates. Moreover, its capacity to compete with foreign coal

in some parts of Germany and in foreign markets has been seriously reduced by the high costs of production. It is true that the German coal industry increased its exports as much as possible in 1925 and 1926 in order to dispose of stocks and to provide its personnel with work and wages. Owing to the threat of a strike in England, which continued for several months, and the long stoppage in the American anthracite mines, it was, indeed, possible to bring the export figure for 1925 up to 18.5 million tons. But, even so, the export figure remained far below the 1913 figure of about 46 million tons, even adding reparations deliveries, which in 1925 amounted to about 14.5 million tons. The following table shows the exports to the different countries in 1913 and 1925 :

Country	1913				1925						
	Hard coal	Hard coal briquettes	Coke	Lignite briquettes	Hard coal	Hard coal briquettes	Coke	Lignite briquettes			
Thousands of tons											
France (1)	3,243	324	2,377	64	5,800	—	4,045	380			
Belgium (1)	5,728	439	937	104	3,885	84	281	77			
Italy (1)	895	133	183	—	2,240	24	112	11			
Austria	12,152	141	1,051	117	324	7	224	66			
Hungary					20	—	16	—			
Czechoslovakia					903	—	186	14			
Poland (included under Russia and Austria in 1913)					7	—	18	27			
Eastern Upper Silesia					24	—	45	—			
Danzig									—	—	20
Memel									40	—	1
Holland	7,218	305	285	282	6,531	386	185	151			
Sweden	185	—	208	—	403	—	209	19			
Norway	19	—	44	—	26	—	35	—			
Denmark	221	96	52	—	165	69	76	157			
Switzerland	1,639	652	364	211	374	50	305	246			
Luxemburg (1)	(incl. 1913 in home consumption)				39	32	1,469	81			
Russia	2,112	—	546	—	—	—	—	—			
Saar Territory	(incl. 1913 in home consumption)				230	—	67	32			
Other countries	1,186	213	386	83	1,212	143	429	15			
Total	34,598	2,303	6,433	861	22,223	795	7,703	1,306			

(1) 1925: inclusive of Reparations deliveries.

The future development of German coal production will depend largely upon changes in costs of production and conditions of competition and markets. As things are at present there appears to be the possibility of development.

Great interest is felt in industrial and mining circles in the recent results obtained in coal chemistry, and especially in oil synthesis, that is to say, in the production of mineral oils from coal by hydrogenation. These results are at present being tested in Germany with a view to their utilisation on an industrial scale. If their economic value is proved, the development of the German coal industry will undoubtedly be stimulated, and it will be compensated to some extent for the losses it has suffered in recent years through the increased use of water power for the generation of electricity, through the progress made in the more economical utilisation of coal for the generation of electricity, the increasing use of oil-fuel, and the adoption of improved methods of heating. At the present time it is impossible to say whether and when this goal will be attained.

The mining industry has devoted much energy to securing the industrial utilisation of inferior fuels and inferior grades of fuel. Favourable results have been obtained, in particular, in coal-dust combustion processes, which are already being extensively used in industry.

To-day imported hard coal comes, for the most part, from Great Britain and the Saar. Small quantities are imported from Holland, Lorraine and Czechoslovakia. Bohemian lignite is imported in fairly large quantities. It cannot, however, be said that particular areas in Germany are dependent upon foreign coal. No doubt British coal delivered on the German North Sea Coast enjoys appreciable advantages in regard to freight rates over German coal, since it is carried by the cheaper sea route; moreover, British coal, on arrival at maritime ports, has the use of navigable waterways which allow it to penetrate far into Germany at low freight-rates. At the end of April 1926, a ton of English Durham gas coal (best), f.o.b. English ports, cost 20.10 marks, and freight to Hamburg 3.77 marks, so that the cost c.i.f. Hamburg was 23.87 marks.

IV. ORGANISATION OF THE GERMAN COAL INDUSTRY.

An article published in the *Handbuch der Kohlenwirtschaft* (1926), entitled "Die öffentliche Bewirtschaftung der Kohle" furnishes information regarding the official and general economic organisations concerned with the coal industry: the Reichskommissar für die Kohlenverteilung, the Reichskohlenverband and the Reichskohlenrat. The functions of the Reichskommissar für die Kohlenverteilung are now practically confined to the oversight of coal imports and exports.

Now that coal supplies exceed the demand on the home and foreign markets and prices are falling, the economic organisations of the German coal industry, the Reichskohlenverband and the Reichskohlenrat, under the supervision of

the Reich Ministry for Public Economy, exercise mainly advisory functions. The fixing of selling prices — formerly their principal task — is no longer practicable. The action taken by these organisations in relation to prices did not always meet with the approval of the industry. As in the case of all official administrative fixing of prices, these organisations could only proceed on the basis of so-called objective standards, in this case the costs of production. It is obvious that this criterion is not alone sufficient in any long view of the necessities of production. A rational business calculation requires higher prices in a period of brisk demand in order to provide against losses at times when sales are insufficient to cover the costs of production. It must, however, be acknowledged that these organisations and also the workers' representatives on them did their best to meet the requirements of the industry as far as this was possible within the limitations stated above. Further, there is no doubt that, during the disturbed period after the war, and particularly during the inflation, the collaboration of employers, workmen and consumers contributed largely towards securing mutual understanding and mitigating differences.

As in the past, the coal industry regards its syndicates as an effective means of developing on stable lines and of reaching normal conditions without injuring the interests of the public or of the workers. The syndication of German coal-mines has aroused much interest abroad, and in some quarters the development of this system on an international basis has been recommended. And if we consider the extreme depression of the coal markets in Europe, which to all appearances is more than a merely temporary phenomenon, as well as the fierce competition on these markets between the coal-producing countries, there are many arguments in favour of an international understanding. Germany and the German coal industry will not refuse their co-operation in this task, although they are conscious that its consummation presents extraordinary difficulties.

**NOTE ON THE GENERAL SITUATION OF THE FRENCH
COAL INDUSTRY**

Communicated by M. DE PEYERIMHOFF DE FONTENELLE

(October 13th, 1926)

NOTE ON THE GENERAL SITUATION OF THE FRENCH COAL INDUSTRY.

I. PRODUCTION.

During the years covered by the statistics of the enquiry, the French coal production was as follows :

Year	Pre-war frontiers Thousands of tons	Post-war frontiers
1909	37,840	40,307
1910	38,350	41,036
1911	39,230	42,263
1912	41,145	44,684
1913	40,844	44,640
1919		22,441
1920		25,260
1921		28,960
1922		31,910
1923		38,556
1924		44,955
1925		48,055

These figures cover the whole production of coal and lignite.

Owing to the comparatively small quantities (793,000 tons in 1913) and to the nature of the lignite extracted, it does not seem worth while to mention it separately or to calculate co-efficients of correction for the total output.

We give below the distribution of the output among the different coalfields in the years 1913, 1919 and 1925 :

	1913	1919	1925
	Metric tons (000's)		
Nord and Pas-de-Calais	27,389	7,883	28,716
Loire	3,796	3,427	4,096
Lyons (Bourgogne - Savoie)	2,603	2,435	3,015
Alais (Gard - Hérault)	2,381	2,067	2,210
Toulouse (Tarn - Aveyron)	1,989	1,723	2,086
Clermont-Ferrand (Centre)	1,531	1,310	1,442
Marseilles (Bouches-du-Rhône - Alpes)	771	771	975
Nancy (Haute-Saône)	191	136	121
Bordeaux (Creuse)	130	114	75
Nantes	81	60	52
	<hr/>	<hr/>	<hr/>
	40,844	19,930	42,776
Lorraine	3,796	2,511	5,279
	<hr/>	<hr/>	<hr/>
	44,640	22,441	48,055

In the period preceding the war the progress of coal production was less rapid than that of national consumption.

In 1903, to meet a consumption of 48,180,000 tons the production amounted to 34,168,000 tons, or 71 per cent. The shortage was therefore 14 million tons.

In 1913 consumption amounted to 64,834,000 tons and production to 40,844,000 tons. The proportion of the consumption covered had therefore fallen to 63 per cent, leaving a shortage of 24 million tons.

During this interval the decline in the proportion covered was fairly regular. The development of production was retarded by the increasing application of the eight-hour day in the mines; owing to this fact, and despite the improvements made in the equipment of the mines, the daily output of the workmen fell from 830 kg. in 1903 to 754 kg. in 1913 in the Pas-de-Calais coalfield, the chief centre of production.

In 1913 the greater part of the output was obtained from the coalfield of Nord and Pas-de-Calais, which alone accounted for two-thirds of the national production. It was here, too, that progress had been most rapid, for the Pas-de-Calais coalfield had doubled its output in the last twenty years and yielded 20,575,000 tons in 1913, or half the total production. The remainder was obtained from the coalfields dispersed throughout the centre and south, which were much less rich and had been worked for a longer time; the output of these coalfields only showed a slight increase — 12,825,000 tons in 1903, 13,455,000 tons in 1913.

The figures of 1919 show the collapse of French coal production as the result of the war. The mines situated within the old frontiers only yielded 19,930,000 tons, or 21 millions less than in 1913. Of this, 19.5 millions were supplied by the Nord and Pas-de-Calais coalfield, and 1.5 millions by the other coalfields.

The primary cause of this collapse was the deficit of the Nord and Pas-de-Calais coalfield. The loss in annual output of the devastated mines exceeded 20 million tons — a deficit which was only slightly reduced by the progress made by the mines in the western part of the coalfield that had not been invaded (Bruay, Marles). Another cause of the reduction of production was the fresh fall in the individual output of the workmen as a consequence of the reduction in the hours of labour in virtue of the Law of June 24th, 1919.

This decline in production necessitated considerable recourse to imported fuel. Although consumption was limited by the lack of supply, a total quantity of 30,125,000 tons of coal, coke and briquettes valued at 7,094 million francs were imported in 1920 according to the Customs statistics, as against coal valued at 583 million francs in 1913. The corresponding values in sterling were 135 millions in 1920 and 23 millions in 1913.

Particularly heavy purchases were made in England, rising from 11,442,000 tons of a value of 280 million francs, or £11,000,000, in 1913 to 12,997,000 tons of a value of 3,866 million francs, or £71,500,000, in 1920.

The result was a crushing burden on the balance of trade. A strenuous effort towards recovery and a great development of national production was essential. The 1925 results indicate the progress achieved. Including the 5,279,000 tons extracted in Lorraine, the production of 1925 amounted to 48,055,000 tons. The mines situated within the old frontiers supplied 42,776,000 tons, showing an increase of 1,932,000 tons over 1913 ; the increase amounted to 1,327,000 tons for the Nord and Pas-de-Calais, and 600,000 tons only for the other coalfields.

Nevertheless, for a fairly stable consumption of 75 million tons, including Lorraine, during the last two years, the shortage of output still amounted to 27 million tons in 1925.

Both from the point of view of geographical situation and of the possibilities of development, the French coal-mines may be divided into the following three groups :

	Output in		
	1913.	1919.	1925.
	Metric tons (000's)		
Centre and South	13,455	12,047	14,060
Nord and Pas-de-Calais	27,389	7,883	28,716
Lorraine	3,796	2,511	5,279

As already mentioned, the centre and the south of France only have deposits of limited extent scattered throughout the country which have been under exploitation for a long period, and in general only permit small increases of output.

The coalfield of the Nord and Pas-de-Calais is the richest and best equipped. It slightly exceeded its pre-war level of output in 1925 and is continuing to make progress ; its output is at present roughly 32 million tons, or 5 million tons more than that of 1913, and it may be expected to make a still larger contribution in the future to the national supply.

The Lorraine basin also shows marked progress, and the resources at its disposal permit of ample development.

Amounting as it does to-day to 51 million tons, France's output still leaves a shortage of some 24 million tons in meeting a present consumption of 75 millions.

This figure of consumption is exactly the same as that of 1913 — 65 millions for the old frontiers and 10 millions for Lorraine. The destruction wrought by the war and the economic depression which followed have hitherto only permitted the recovery of consumption to its former level, which in reality constitutes a setback in the normal process of evolution. During the ten years which preceded the war, the consumption of coal regularly increased by more than 1½ million tons a year on an average. It is therefore to be anticipated that the industrial development which has taken place since the war will result in further increases in the consumption of coal, despite the competition of liquid fuel and hydraulic power.

The requirements of the balance of trade and of purchasing power abroad, the lack of liquid fuel in France, the prospects of consumption, and the possibility of developing the mines of Pas-de-Calais and Lorraine, lead to the hope, and, provided suitable measures are taken, to the conviction that France's output of coal will be increased in the course of the next few years.

It seems reasonable to suppose that an output in the neighbourhood of 60 million tons can be attained in a few years. This would still leave 15 million tons to be provided for by importation, plus the amount exported and any increase which may take place in consumption.

II. IMPORTS AND EXPORTS.

The total, estimated in rough coal, of imports of mineral fuel during the last few years amounts to the following figures according to the Customs statistics :

	Within former frontiers Metric tons (000's)		Within present frontiers Metric tons (000's)
1909	18,931	1920	31,279
1910	18,827	1921	24,200
1911	20,410	1922	30,569
1912	20,717	1923	31,828
1913	23,775	1924	33,201
		1925	30,840 ¹

As we have already pointed out, the extension of imports before the war led to an increase in consumption (56,354,000 in 1909 ; 64,834,000 in 1913) more rapid than that of the national output (37,840,000 in 1909 to 40,844,000 in 1913), which was retarded by the progressive reduction in the hours of labour.

Immediately after the war consumption was small, but the deficit resulting from the devastation of the mines of the Nord and Pas-de-Calais had to be covered. Imports therefore stood at a high figure, but suffered a comparative setback in 1921, which was a year of general economic crisis and exceptionally reduced consumption.

From 1922 onwards consumption has been regularly on the increase, but the advance in production was sufficient to cope with it. In 1925 began the movement to reduce imports as a result of the continuous increase in national production and of the excessive financial burden of purchases abroad.

The burden of purchases abroad and the possibilities of development of the French coal-mines lead us to anticipate fresh reductions in imports in the course of the next few years. Nevertheless, for various reasons, France must continue to rely on foreign countries for a considerable proportion of her supply in mineral fuel.

¹ Corrections have had to be made in the 1925 Customs figures to allow for the inclusion of the Saar Territory within the French Customs boundaries since January 11th, 1925, and deliveries from the Saar to France must be added to the Customs import figures. The figure given above is an approximate one arrived at after making the necessary correction.

A detailed analysis of imports according to the country of origin shows the main factors of the movement of trade:

England. France's imports from England have been as follows :

	Coal	Coke	Briquettes
	Metric tons (000's)		
1909	9,379		144
1910	8,470		121
1911	9,099		121
1912	9,022		122
1913	11,257		174
1919	14,314	617	715
1920	11,932	667	887
1921	5,892	22	206
1922	12,099	70	138
1923	17,962	385	163
1924	13,019	53	110
1925	9,936	9	168

The year 1913 showed a marked increase on the four previous years, the average of which was less than 9,000,000 tons.

The volume and, still more, the value of imports were temporarily and artificially inflated after the war owing to the shortage of output of the devastated French mines and to the cessation of deliveries from Germany during the occupation of the Ruhr. The British coal-mines thus found an abnormally large and remunerative market in France.

In 1925, the volume of imports from England once more fell below the figure for 1913 but remained superior to the average for the years 1909-1912.

Imports from England consist for the most part of coal for the use of the coastal zones at a distance from the French mines. They also include a considerable tonnage of anthracite and special qualities for domestic requirements.

France's financial and economic situation limits her purchasing power abroad and makes it imperative to pay strict attention to the essential factors of her balance of trade and to draw more largely upon her growing national production. In particular, the prohibitive prices reached in recent years by English anthracite have led to its replacement by coke and close-burning coal of home production.

Belgium. Imports from Belgium oscillated from 4,163,000 tons in 1909 to 3,659,000 tons in 1913 for coal, 760,000 to 640,000 tons for briquettes, and in the neighbourhood of 500,000 tons for coke. The total quantities showed a slow but regular downward trend from 1909 to 1913.

Imports in 1925 were in the neighbourhood of 1,897,000 tons of coal, 663,000 tons of briquettes and 498,000 tons of coke. The only appreciable change was therefore in the case of coal, which shows a material reduction corresponding

to the relative decrease in Belgian available supplies. Imports from Belgium consist chiefly of close-burning coal for domestic consumption, and in compensation France exports industrial coal — amounting in 1925 to 1,417,000 tons. An exchange of qualities therefore takes place between the two countries.

Germany. German imports into French post-war territory may be estimated at about the following figures in 1913 :

	Tons
Coal	3,396,000
Coke	5,427,000
Briquettes	187,000
	9,012,000

equivalent to 10,788,000 tons in terms of coal.

For the years 1924 and 1925 the Customs statistics are as follows :

	1924	1925
Coal	4,265,000	5,517,000
Coke	4,540,000	4,115,000
Briquettes	461,000	387,000
Total	9,266,000	10,019,000

equivalent in terms of coal to : 10,582,000 11,216,000

The total figures show no appreciable change as compared with the situation before the war.

The imports include a large tonnage of coke for the requirements of the metallurgical industry of Eastern France. The coal is sent to these districts up the Rhine and by way of the land frontiers, or via Rotterdam to the seaports, where it competes with English coal.

Saar. The geographical proximity of the Saar mines explains the import from that district, amounting in 1925 to 4,804,000 tons of coal and 78,000 tons of coke.

France's exports are small, amounting in the last few years to the following figures in terms of coal, that for 1925 having been duly corrected to allow for the removal of the Customs frontier to the outer periphery of the Saar Territory :

1923	3,156,000 tons
1924	3,072,000 „
1925	2,808,000 „

As we have already explained, the trade between France and Belgium may be described as an exchange of qualities.

Owing to the common frontiers with Italy and Switzerland — countries which have no coal supplies of their own — there is a regular exportation of French coal and coke to these countries.

III. CUSTOMS TARIFFS.

At any rate, as regards mineral fuel, the French Customs tariff has not yet been adjusted to the new monetary conditions of the country. An import duty of 1.20 francs per ton gave before the war a protection of about 5 per cent. The same duty, maintained hitherto at 1.20 paper francs without coefficient of increase, now only constitutes a protection of about 1 per cent.

The deficit in the national production has made it possible to postpone for the present the adjustment of the tariff on mineral fuel. Recently the only changes have been two successive increases of 30 per cent in all Customs duties in 1926.

Imports and exports are normally free. It is only in the case of serious economic disturbances that the Government introduces a temporary system of licences. For example, the shortage of supplies resulting from the prolonged coal dispute in England made it necessary to subject exportation to the granting of a licence.

IV. ADJUSTMENT OF PRODUCTION TO CONSUMPTION.

During the pre-war period, the curve of consumption showed a regular increase. National production increased much more slowly, the proportion of consumption covered falling from 71 per cent in 1903 to 63 per cent in 1913. In absolute figures the annual shortage rose during the same period from 14 millions tons in 1903 to 24 millions in 1913.

During this period of growing home requirements, the mines were little affected by the annual variations, slight as they were, of consumption.

Since the war consumption has steadily risen, except in 1921, a year of general crisis. Moreover, French production had fallen to such a low level that the question of markets did not arise.

It was not until 1924 that the proportion covered amounted once more to 60 per cent, rising to 64 per cent in 1925 and 68 per cent on the present basis of production, assuming consumption to be constant. Relatively France is now in a position intermediate between that of 1903 and 1913.

In absolute figures the shortage of production has become incomparably more severe, rising in succession from :

14 million tons in 1903 to	
24	1913
30	1924
27	1925
24	present basis.

The increasing margin uncovered by home production and the relatively low level of French internal prices during a period of continuous monetary depreciation have hitherto provided a ready outlet for a rapidly increasing production. It is probable that considerable progress may still be made towards covering a larger proportion of the country's requirements without incurring the risk of too serious a reaction on the regular activities of the French mines.

Nevertheless, each stage of progress brings us nearer to a situation of equilibrium in which the variations of consumption will be more directly felt by the French mines. Moreover, the stabilisation of the currency will lead to a diminution of the present discrepancy between home and world prices, and also no doubt to a temporary reduction in the consumption of fuel, so that questions of competition will probably tend to become more acute on the French market. The coal industry must therefore face this prospect and study the possibility of reducing its cost of production — *i.e.*, of improving the output of its workers — and must endeavour to achieve a maximum of elasticity in production.

Much remains to be done as regards the output of the workers. As compared with 1913 the individual output is 14 per cent lower in the French mines, although it has been restored to par in Belgium, and shows an increase of 21 per cent in the Ruhr. More striking still is the disparity between the 1,130 kilos. of daily output in the Ruhr and the 602 kilos. in the French mines. It is true that the differences in the lie of the deposits are considerable, but they are not sufficient to justify such a disparity. The relative fall in the French output is the result of the rapid increase in the number of workers employed, and, still more, of the legal reduction in hours, which progress in technical equipment has not yet been able to counterbalance.

In anticipation of more difficult times and of the economic necessities which are bound to make themselves felt, it is essential that the French mines should improve the conditions of output without delay and thus reduce the costs of production. An increase of production therefore appears desirable and practicable without a proportional increase of the labour employed.

Furthermore, some change in the rates policy of the French railways is every day becoming more essential. Rates judiciously adapted, as the result of long experience, to the economic and geographical conditions of the country were ruthlessly abandoned during the war and replaced by a single scale of charges obviously lacking in elasticity. The few corrections since introduced under the pressure of manifest necessities are of trifling importance. A methodical readjustment of an excessively simplified scale of charges might have an appreciable effect in restoring the markets for French coal.

An endeavour to restore the relative position in the face of foreign competition is the more necessary as coal-mining is essentially a heavy industry entirely deficient in facilities for rapidly varying its output in accordance with substantial fluctuations in consumption. The extent of the necessary preliminary work leaves only a small margin of variation for production; the

temporary abandonment of poor strata is only a doubtful and dangerous palliative; the accumulation of stocks has limits; and a coal area does not often offer other opportunities for employing labour outside the mine. Partial unemployment rapidly becomes a necessity in the event of any serious market crisis. The fact that a large and, in recent times, rapidly increasing proportion of mining labour in France consists of foreign elements, as yet comparatively unsettled, is clearly of a nature to relieve the potential acuity of the problem. It is preferable, and indeed perfectly possible, that the application of suitable measures should prevent the problem from arising.

V. ORGANISATION.

Sales syndicates do not exist in the French coal-mining industry.

Each mining company effects its own sales direct, seeks a commercial outlet for its products and fixes its prices, which are negotiated between the producers and the consumers or merchants.

Nevertheless, for economic and social reasons, the general policy of the coal-mining industry is to obtain the greatest possible stability in its selling prices; as its exports are insignificant, it is able to achieve this with comparative ease. It endeavours to prevent an excessive rise in periods of large demand and to resist a fall in periods of crisis.

With this end in view, the mines belonging to the same area have joint organs to study the market position. The changes in price recognised as necessary or expedient are thus introduced simultaneously in the same region in order to prevent sudden displacements of orders.

At no stage does the Comité Central des Houillères intervene in questions of selling prices, which remain exclusively under the control of the mining companies. In each coal area the local producers jointly adjust their commercial policy to the market situation.

Table 1. — TOTAL CONSUMPTION IN TERMS OF COAL (1909-1924).
Tableau 1. — CONSOMMATION TOTALE ÉVALUÉE EN HOUILLE CRUE (1909-1924).

	1909	1910	1911	1912	1913	1920	1921	1922	1923	1924	
en milliers de tonnes — In metric tons (000's)											
Variation du stock (+ ou —)	+ 253	+ 342	— 287	— 780	— 167	+ 346	+ 806	— 442	— 402	?	Changes in stocks (+ or —)
Production	37.840	38.350	39.230	41.145	40.844	25.260	28.960	31.910	38.556	44.955	Production
Excédent (équivalence de houille crue) des importations sur les exportations	17.392	17.202	18.724	18.339	21.973	30.770	21.729	27.746	28.672	30.129	Excess (in terms of coal) of import over export
Équivalence en houille des charbons et ag- glomérés français et étrangers embarqués comme soutes sur des navires français (commerce général)	1.175	1.215	1.153	1.365	1.709	1.280	1.418	1.739	1.776	1.829	Coal equivalent of bunker coal and briquettes (French and foreign) supplied to French vessels (general trade)
Consommation totale	56.154	56.425	59.394	61.629	64.693	56.964	51.301	61.837	69.406	76.913	Total consumption
Consommation totale donnée par la Sta- tistique générale de l'industrie minière	56.354	56.530	59.530	61.623	64.834	59.591	50.197	60.356	68.475	—	Total consumption as calculated by the statistics of the mining industry

Pour les années 1920 et suivantes, les chiffres de consommation calculés d'après les statistiques douanières sont systématiquement supérieurs aux chiffres donnés par la statistique officielle de l'industrie minière. Les écarts proviennent de question de charbons de soutes et d'entrepôts.

For 1920 and the following years the consumption figures calculated according to the Customs returns are systematically higher than the figures given by the official statistics of the mining industry. The differences arise over the question of bunker and *entrepôt* coal.

Table 2. — THE COAL SITUATION IN FRANCE IN 1925.
Tableau 2. — SITUATION HOUILLÈRE DE LA FRANCE EN 1925.

	Houille Coal	Coke Coke	Agglomérés Briquettes	Equivalents en houille crue Total in terms of coal	
<i>Production houillère</i>	48.054.900			48.054.900	<i>Production of coal</i>
<i>Importations :</i>					<i>Imports from :</i>
Grande-Bretagne	9.936.764	9.347	168.397	10.100.472	Great Britain
Belgique	1.897.713	498.778	663.029	3.142.851	Belgium
Etats-Unis	204.199	—	—	204.199	United States
Allemagne	5.517.944	4.115.402	387.990	11.218.157	Germany
Pays-Bas	563.677	372.407	—	1.047.806	Netherlands
Autres pays	176.120	8.130	41.308	223.867	Other countries
Sarre	4.804.118	78.730	—	4.906.467	Saar
Importations totales	23.100.535	5.082.794	1.260.724	30.843.819	Total imports
				78.898.719	
<i>Exportations :</i>					<i>Exports :</i>
Exportations totales, y compris celles de la Sarre (Douanes)	4.506.443	473.196	142.649		Total exports, inclu- ding those of the Saar (Customs returns),
A déduire les expor- tations de la Sarre	2.378.658	48.475	—		Saar exports to be deducted
	2.127.785	424.721	142.649	2.808.307	
Augmentation des stocks des mines				459.300	Increase in colliery stocks
				3.267.607	
			Consommation	75.631.112	Consumption

Table 3. — CONSUMPTION BY CLASSES OF CONSUMERS ¹.
Tableau 3. — CONSOMMATION PAR CATÉGORIES DE CONSOMMATEURS ¹.

	1909	1910	1911	1912	1913	
	en millions de tonnes Metric tons (000's)					
Métallurgie	9.313	10.082	10.911	11.425	12.545	Metallurgical indust.
Chemins de fer	7.950	8.158	8.607	8.966	9.069	Railways
Industrie des mines	4.546	5.012	4.931	4.921	5.054	Mining industry
Usines à gaz	4.213	4.253	4.495	4.532	4.656	Gas-works
Marine marchande	1.349	1.260	1.281	1.160	1.720	Mercantile Marine
Industries diverses	18.099	16.173	18.195	18.020	19.811	Sundry industries
Consommation do- mestique	10.884	11.592	11.110	11.775	11.979	Household consump- tion
Ensemble	56.354	56.530	59.530	60.799	64.834	Total
		1920	1921	1922	1923	
Métallurgie		8.825	8.168	10.620	11.159	Metallurgical indust.
Chemins de fer		11.055	11.425	11.165	11.565	Railways
Industrie des mines		3.514	3.655	3.700	4.917	Mining industry

¹ Source : Statistique de l'industrie minérale.

Table 4. — CONSUMPTION OF COAL, COKE, ETC. IN FRANCE CALCULATED
IN TERMS OF COAL.

Tableau 4. — CONSOMMATION DE HOUILLE, COKE, ETC., EN FRANCE
ÉVALUÉE EN HOUILLE CRUE

	Consumption Total Consommation totale	Consumption per head Consommation par tête d'habitant
	Tonnes Metric tons	Kg. Kg.
1909	56.154.000	1.431
1910	56.425.000	1.437
1911	59.394.000	1.500
1912	61.629.000	1.556
1913	64.693.000	1.633
1920	56.964.000	1.453 ¹
1921	51.301.000	1.308
1922	61.837.000	1.577
1923	69.406.000	1.770
1924	76.913.000	1.962

POPULATION OF FRANCE (CENSUS FIGURES).

POPULATION DE LA FRANCE SELON LE RECENSEMENT.

du 4 mars 1906	39.252.245	March 6th, 1906
du 5 mars 1911	39.604.992	March 5th, 1911
du 6 mars 1921 (avec) l'Alsace- (with) Lorraine	39.209.518	March 6th, 1921

¹ Selon le chiffre du recensement du 6 mars 1921.

¹ Census figure of March 6th, 1921.

NOTE ON CERTAIN ASPECTS OF THE COAL PROBLEM

Communicated by Professor T. W. PAGE

(January 10th, 1927)

NOTE ON CERTAIN ASPECTS OF THE COAL PROBLEM.

I. SUBSTITUTION OF OTHER FUELS AND OF WATER-POWER FOR COAL IN THE UNITED STATES.

The accompanying table shows by five-year periods the United States production (not consumption) of coal, petroleum and natural gas, and the horse-power capacity of water-wheels, together with the total coal equivalent.

The consumption of these sources of heat and power has been, throughout this period, but little less than the production. Exports have been either relatively small or (in the case of petroleum during recent years) substantially offset by imports.

The table exaggerates somewhat the displacement of coal by other fuels for the reason that it does not include firewood. The present consumption of wood for fuel is estimated, very roughly, as equal in heat capacity to about 7 or 8 per cent of that of the coal used. In the early years covered by the table the proportion was materially higher. Wood was at least as important as coal in household heating in 1870, and was probably equal to from 10 to 15 per cent of the coal in all uses combined. The decrease in the relative importance of firewood is believed to have been rapid from 1870 to about 1900 and much less rapid since that time.

Conversions to coal equivalent have been made as follows: petroleum at 4.2 barrels to 1 ton (2,000 pounds); natural gas at 22,000 cubic feet to 1 ton. In the case of water-power, different factors are used at different times on the assumption (1) that the water-wheels have progressively delivered more hours of energy per year, and (2) that the coal required to produce a horse-power hour has gradually declined. Thus for 1871-1875 each horse-power capacity in water-wheels is assumed to have operated 2,400 hours per year, and the coal required for one horse-power to have been 6 pounds. For 1921-1925 the corresponding ratios used are 3,600 hours and 3 pounds.

COAL EQUIVALENT OF PRODUCTION OF PRIMARY SOURCES OF POWER.
(The ton is that of 2,000 pounds.)

	Petroleum Million barrels	Natural gas Billion cu. ft.	Water- power 1,000 h. p. capacity	Coal equivalent — million tons				Popu- lation Millions	Per cap.	
				Coal	Oil	Gas	Water- power		Total	Coal Tons
1871-75	9	—	1,130	52	2	—	5	62		
1876-80	17	—	1,180	62	4	—	7	73	42.1	1.24
1881-85	25	—	1,225	107	6	—	6	119	47.9	1.30
1886-90	33	135 ¹	1,250	138	8	—	6	158	54.1	1.98
1891-95	51	100 ¹	1,300	179	12	6	6½	158	60.5	2.29
1896-1900	59	130 ¹	1,700	227	14	5½	6½	203	67.0	2.67
						6	9	256	73.5	3.09
										3.5

¹ Estimated from the values reported.

	Petroleum Million barrels	Natural gas Bilhon cu. ft.	Water- power 1,000 h. p. capacity	Coal equivalent — million tons				Total	Popu- lation Millions	Per cap.	
				Coal	Oil	Gas	Water- power			Coal Tons	Total Tons
1901-05	102	260 ¹	2,100	339	24	12	13	388	81.0	4.19	4.8
1906-10	173	437	3,200	455	41	20	19	535	89.1	5.10	6.0
1911-15	248	576	4,800	529	59	26	26	640	96.5	5.48	6.6
1916-20	363	763	6,700	626	86	35	38	785	103.6	6.05	7.6
1921-25	646	947	8,000	560	154	43	43	800	111.7	5.01	7.2
1925	756	1,188	9,500 ²	585	180	54	51	870	115.4	5.07	7.5
Per cent of total :											
1891-95				88	6	2½	3½				
1901-05				88	6	3	3				
1911-15				83	9	4	4				
1921-25				70	19	5½	5½				
1925				67	21	6	6				

II. PROGRESS IN ECONOMY OF FUEL CONSUMPTION IN THE UNITED STATES.

The accompanying tables show in a very approximate manner the change in the quantity of fuel used as compared with the change in output of energy or work between 1911-1915 and 1921-1925. Were data available for a comparison with the single year 1925, much more marked economy would be disclosed, since improvement has been especially rapid since the close of the war.

Consumption of gasoline and kerosene (illuminating oil) are not taken into consideration because of lack of adequate data as to the energy developed by them.

Table 1. — FUEL CONSUMPTION.

(In terms of tons of 2,000 pounds of coal or coal equivalent)

	1911-1915	1921-1925	Per cent increase
Coal	513,000,000	540,000,000	5
Oil	33,000,000	75,000,000	125
Natural gas	26,000,000	43,000,000	65
Total	572,000,000	658,000,000	15
Population	96,500,000	111,700,000	16

Table 2. — PRINCIPAL FORMS OF HEAT AND POWER OUTPUT DERIVED
FROM FUEL.

Output :	Approximate percentage	
	increase, pre-war to post-war period	Weight assigned
Domestic heat	16	20
Industrial fuel-generated power, including electric current	41	27½
Industrial heat	15-25	27½
Railway transportation service	30	25
Weighted average	26-28	100

¹ Estimated from the values reported.

² Estimated.

III. SUPPORTING DATA.

1. Consumption of coal (tons of 2,000 pounds) :

	Annual average	
	1911-1915	1921-1925
Production	529,000,000	560,000,000
Net exports	16,000,000	20,000,000
Consumption	513,000,000	540,000,000
Population (1913 and 1923)	96,500,000	111,700,000
Consumption <i>per capita</i>	5.3	4.8
Increase in consumption	5.3 %	
Increase in population	16 %	

2. Consumption of oil as fuel :

Note. — The increased use of gasoline, largely consumed by automobiles, is disregarded, although, in computing power generated, in paragraph 5 below the power of internal-combustion engines in factories and electric stations, which use rather small quantities of gasoline, is included.

	Barrels of 42 gallons	
	1911-1915	1921-1925
Total crude oil consumed	253,000,000	675,700,000
Less :		
Used by refineries	178,000,000 ¹	583,800,000
Estimated use for roads, etc.	5,000,000	7,000,000
Crude oil used as fuel in U.S.	70,000,000	85,000,000
Fuel and gas oil produced by refineries	80,000,000 ¹	290,000,000
Total	150,000,000	375,000,000
Less :		
Exports of fuel and gas oil (net)	9,000,000	21,500,000
Bunker oil laden on vessels in foreign trade (est.)	2,500,000 ²	36,500,000
Balance consumed in U. S.	11,500,000	58,000,000
	138,500,000	317,000,000
Coal equivalent at 4.2 barrels per ton	33,000,000	75,000,000

¹ Estimated from figures for 1914 (*Statistical Abstract*, 1923, page 278), viz., 191,000,000 barrels of crude oil consumed by refineries and 89,000,000 barrels of fuel and gas oil produced.

² Estimated from figures for 1915 (*Statistical Abstract*, 1923, page 278), viz., 3,566,000 barrels.

3. *Consumption of natural gas :*

	1911-1915	1921-1925
Total consumption, 1,000 cubic feet	576,000,000	947,000,000
Coal equivalent at 22,000 cubic feet = 1 ton		
Tons	26,200,000	43,000,000

4. *Household heat :*

Between 1913 and 1923, population increased 16 per cent. This figure may be taken as representing the minimum increase in domestic heat produced. Many homes are now more completely heated, and the rooms kept at a higher average temperature, than formerly. Moreover, the proportion of homes (mainly farm homes) using firewood for heating is considerable but declining, and the computations of fuel consumption take no account of wood.

5. *Industrial power, including generation of electric current :*

An approximation as to the increase in power generated in factories, mines, and electric stations may be gained from the data as to the horse-power capacity of prime movers using fuel as motive power. The electric stations report actual kilowatt-hour output, which shows a decidedly greater average output per unit of prime-mover capacity in recent than in pre-war years ; the same may be true in some degree of factories and mines, but no allowance is made for it.

CAPACITY OF FUEL-USING PRIME MOVERS (HORSE-POWER)

	Pre-war	Post-war
Factories (1914 and 1923)	16,580,000	17,925,000
Mines (1909 and 1919)	4,305,000	5,073,000
Central electric stations (1912 and 1922)	5,061,000	14,474,000
Electric railways (1912 and 1922)	3,190,000	3,715,000
	<hr/>	<hr/>
Total	29,136,000	41,187,000

Increase 41 per cent.

6. *Industrial heat :*

The largest single consumer of fuel for industrial heat is the blastfurnace industry. The output of pig iron has been (annual averages) :

1911-1915	27,518,000 tons
1921-1925	30,475,000 tons

Increase 11 per cent.

However, most industries using large quantities of heat have shown much greater gain in output, for example (annual averages) :

	1911-15	1921-25	Increase %
Steel ingots and castings (tons)	28,378,000	36,753,000	30
Finished rolled steel (tons)	22,250,000	27,195,000	22
Copper, output of smelters from domestic ore (tons)	610,313	621,812	2
Copper, refined, from domestic and foreign ores (tons)	778,500	868,300	12
Manufactured gas, sales (1,000 cubic feet)	188,750,000	377,750,000	103
Rubber tires (casings) (number, 1914 and 1925)	8,021,000	57,481,000	616
Petroleum-refining :			
Barrels of oils run to stills (1914 and 1923)	200,700,000	652,900,000	225

The increase for all industries was certainly not less than 15 per cent and probably 25 per cent or more.

7. *Railroad transport service :*

The increased volume of power output may be judged fairly from the gross ton mileage of freight (including weight of cars and contents, but not that of locomotives and tenders), and the mileage run by passenger-train cars :

	1911-1915	1921-1925	Increase %
Gross ton miles in freight traffic	657,946,000,000	907,869,000,000	38
Mileage of passenger-train cars	3,264,000,000	3,592,000,000	10

As passenger cars are heavier and move faster than freight cars, they take more fuel per car-mile. The ratio of fuel consumption is $2\frac{1}{2}$ to 3 for freight, against 1 for passenger. A weighted average of the above percentage of increase is therefore about 30 per cent.

The increased economy of railroad fuel consumption in recent years is shown by data of actual locomotive consumption (coal and coal equivalent of oil and wood) in passenger and freight service per unit of service. Data are available only for the years shown below :

	Pounds of coal or equivalent consumed, per :	
	1,000 gross freight ton-miles	passenger train train-car mile
1920	197	18.8
1921	185	17.7
1922	186	17.9
1923	183	18.1
1924	170	17.0
1925	159	16.1
1926 (approximate)	155	—