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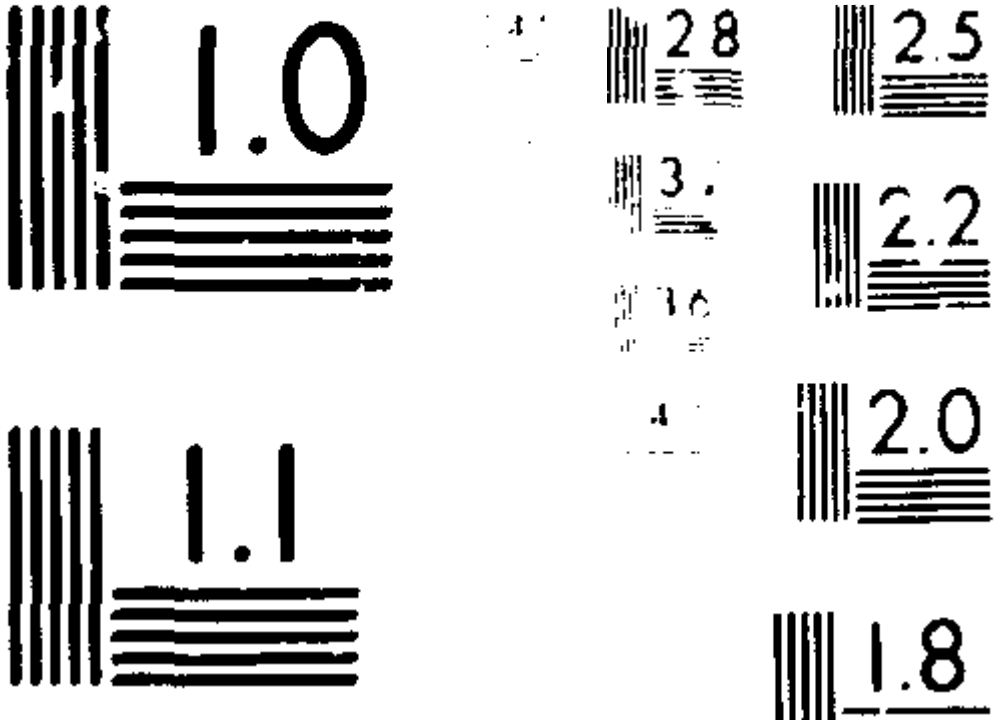
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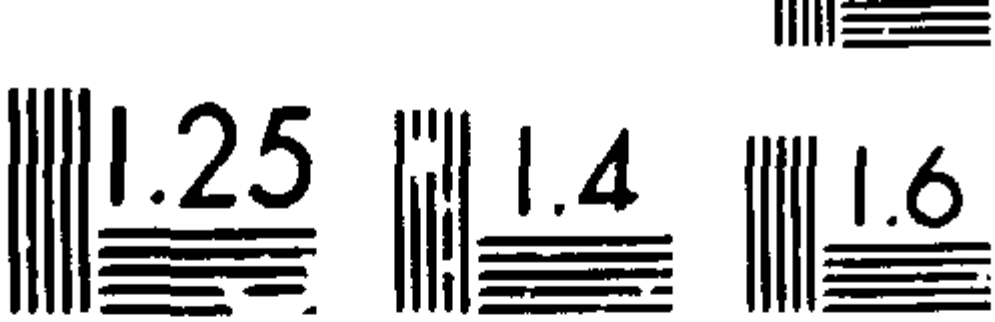

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METALLURGICAL COAL IN THE 1980's - FACTS AND PROSPECTS *

by

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G E N E R A L R E V I E W

RESERVES

Coal can be classified as by far the most ample fossil fuel. There is enough coal for the foreseeable future if only mineable reserves are taken into consideration. The 1978 WEC Report gives the economically recoverable world hard coal reserves as high as 492 billion tons of which about 48 billion in the market economy developing countries. Roughly one fourth of today's hard coal reserves can be regarded as of metallurgical quality /see table 1/. On the basis of present knowledge the developing countries /China not included/ are not as well endowed with coal as the industrialized countries. This picture may change taking the development of the Australian coal mining during the last decade. Similar opportunities seem to exist in other countries such as in India, Brazil, Colombia, Botswana and Nigeria. The developing countries have not made sufficient efforts to explore for coal. To change this situation is one of the important tasks.

OUTPUT

Until 1973 there has been little inducement /with few exceptions/ to raise coal output. The prospects have been changed by the multifold increase in the price of crude oil. The oil crisis compelled reactivation of the role of coal in the energy scenario. Hard coal output in 1980 is expected to reach 2,8 billion ton target against 2,2 billion in 1974 and in 1970. Relevant figures for the market economy developing countries are 124 and 152 mtons respectively. The estimates of this survey are that the hard coal output will rise to 3,4 billion ton by 1985 and to 3,5 billion ton by 1990 of which in market economy developing countries to 240 resp. 270 mtons /see table 2/.

Main gains are expected in USA, Canada, Australia, South Africa, India, USSR, Poland and China. Likely production figures have been based on the most recent statements and governmental policies on the subject but have not necessarily followed published intentions. More ambitious targets than above stated and described in national surveys that follow, seem unrealistic in view of some limiting factors. Among them the time needed, the ability to finance, the environmental constraints, the availability of skilled manpower and the capacity of industries providing necessary equippment /for collieries, user plants, transport etc./ must be taken into account.

DEMAND

Coal demand will be largely affected by steel industry /metallurgical coal/ and by energy sector /thermal coal/. Steel production in 1980 is expected to reach a target of about 754 mtons against 597 mtons in 1970. Relevant figures for the developing countries incl. CP Asian countries are 100 mt /13,3% of the total/ against 43 mtons in 1970 /7,2%/.
In this survey a growth rate is taken worldwide as high as 2,5%/yr of which for industrialized countries - 2,0%/year and for developing ones - 5%/year. These assumptions lead to the steel output of 850 mt /1985/ resp. 960 mt /1990/ of which developing countries may contribute to 130 mt /15,2%/ resp. 163 mt /17%/. For more detailed data see table 3.
Above figures indicate the order of magnitude likely to occur judging from depressed internal steel demand in saturated industrialized area and from the capacity of the advanced "expansion" projects only in Latin America as well in ME Asian developing countries. A growth of steel output during the coming decade by about 27% will necessitate an 20% growth in metallurgical coal demand, demonstrating further possibilities for coke economy as well the growing share

of alternative OR/EF process routes. This means that the present demand of 450 mtons of metallurgical coal will rise to about 495 mtons /1985/ and to about 530 mtons /1990/. Above stated figures do not include CPEAsian developing countries because no secured data are available. Market economy developing countries will use about 45 mt of metallurgical coal by 1985 and about 60 mt by 1990 against the present level of 32 mt /see table 4/.

Problems regarding the demand of thermal coal were there not discussed. The future of this coal will be largely influenced by the power plant programs both in developed and in the developing countries. The central question is when and to a what extent coal will replace oil in the existing power plants and what new coal fuelled electrical capacity could be created in the period under review. According to the most recent opinions the demand for thermal coal from external sources will rise more dynamically han that for metallurgical coal since it is the only significant, quick alternative to oil for power generation in the 1980's.

TRADE

Trade in coal has always been a marginal part of the output. The current figure about 220mt represents only 8% of world production. Still lesser ratio is obtained when "sea borne" trade /about 155 mt annually/ is taken into account, disregarding the quantities "intrabloc" traded between USA and Canada, within EEC and within CMEA countries.

Future potential sellers will undertake the firm investments only if they are quite sure to sell coal at a reasonable price on a stable and long-term basis. The caution in both: buyers and sellers in making investment commitents is exacerbated by the long lead time and financial risk involved in developing coal resources.

The consensus of this survey is that coal trade will grow moderately during the 1980's bearing in mind the circularity between demand and supply as well as some logistic and transport problems. The current figure for trade in metallurgical coal is 110 mtons, i.e. nearly the same as in record year 1974, of which 20 mtons annually are imported by the ME developing countries in Latin America and Southern Asia. Above mentioned countries will import probably 30 mt/year of metallurgical coal in the mid 1980's and beyond from external sources. Some additional demand as high as of 10 mt/year annually is expected in the industrialized area. This means that from the demand side about 130 to 140 mt of metallurgical coal could be traded annually as the likely scenario in the 1980's.
Significant additional tonnage of thermal coal will also be required. The oil crisis and the shippage of nuclear programs will have to encourage diversification from oil to coal fired coastal stations particularly in Western Europe and in Japan. This means that greater quantity of thermal coal could be traded on world market as in case of metallurgical coal.
Most commentators agree that increased internal demand for metallurgical coal will be sourced mainly in USA, Australia and Canada, while that for thermal coal in Poland, South Africa, India and China /see table 5/.

PRICES

Prices for metallurgical coal are not well documented. They are predominantly influenced by the price of US exporters because of coal premium quality, export potential and high elasticity in securing the changing foreign demand. In the record 1974 year US metallurgical coal price /cif ARA ports/ nearly tripled, since then remaining fairly stable at 60-62 US doll./ton. Fairly steady nominal US

dollar prices mean a decline of coal real price in view of inflationary impact. Wages paid to coal miners increased nearly three times against 1970 figure while the productivity declined substantially.

Metallurgical coal delivered by Canada, Australia and Poland is cheaper by 10-25% in comparison with US coal mainly due to the difference in quality. Coal from Australia has been quoted cif ARA ports /1978/ at 50 doll./ton and from Poland at 54 doll./ton. Distinct price differences between various qualities of metallurgical coal can be exemplified by cif prices on Japan's imported coal in US dollars at current exchange rates /see table 6/. Fob export metallurgical coal prices are approximately 1,6 fold higher than that of thermal coal ones. This difference is greater than the difference in calorific value between these two fuels but in line with cost differential of mining and upgrading.

Fuel oil is a poor economic substitute for metallurgical coal over a wide range of relative prices per unit of heat.

Sources of low volatile "heavy coking" coal for international trade are limited with advances in technology and the desire to broaden supply base there is now a movement towards the lower priced high volatile, "soft coking" coals.

The metallurgical coal trade scenario will move from a few suppliers and few users to a more diverse coal sources and markets. Competition between coal suppliers will help to restrain coal prices in the international trade. As regards transport across Ocean routes there should still be some ways of stabilizing or even reducing freight charges against the present level of 10-12 doll./ton on USA--Europe and Australia - East Asia routes resp. 20-24 doll./ton on Pacific routes from West Canada to Japan resp. from Australia to Europe/ see table 7/.

Production costs /incl. transport/ will remain the decisive factor as determinant of coal prices.

COSTS

Data on capital and operational costs in coal mining are not well documented. Where available - they have been presented in the attached national surveys. Cost figures as given for some major producing countries must be viewed as an order of magnitude expressed in US dollars at 1974 resp. 1977 exchange rate. It is not possible to present absolute cost figures applicable to every project. Available data are not sufficient to answer the question whether and how the investment costs for coal mining in developing countries can differ from those in industrialized countries. Historically the mining projects were small. The coal mining in industrialized countries were virtually selffinancing. With the increase in size and cost of new projects financing became more and more difficult. The capital requirements from external sources are currently a "conditio sine qua non".

For financing the coal mining activities the following sources beside own ones can be quoted:

- partnership and equity to other;
- credits by governments on favourable terms;
- by coal consumers in connection with long term contracts for supply.

As a consequence of a recent economic situation the financing of coal mining projects in developing countries must be regarded as a topic of regional and international discussions. In a global view it is very probable that the historical trend of an increase in the coal production costs /above the level of inflation/ will continue. Production costs for metallurgical coal - mainly to be mined under-

ground - will increase more dynamically than for thermal coal from open pits.

TECHNICAL PROGRESS

The general consensus is that the BF/BOF route will continue to dominate the steel scenario in the 1980's. Its decisive advantage is high productivity, high thermal efficiency and insensib lity to iron ore quality.

DR/EF route will doubtless open new prospects particularly in Latin America and in Arab World, where cheap natural gas combined with high grade pellets can be transformed to sponge iron. These prospects should not be overestimated bearing in mind the higher energy intensivity /by about 30%/ of the whole route from ore preparation to electric sponge iron melting. It seems necessary to develop alternative sponge iron melting processes. This could be an area for cooperation between industrialized and developing countries.

Coal gasification will not make substantial contribution as a source of the reducing gas for DR processes due to high operational and investment costs combined with relatively low thermal efficiency of coal gasification. For economic feasibility of such undertaking very low coal costs against cost of hydrocarbon fuel are of fundamental importance. The coking industry will continue to use conventional carbonization technique in slot ovens. A trend towards tall coke ovens 6,0 m in height and over 30 cubic meter by volume will help to raise productivity and to lower operational costs. Coal stamping and to a lesser extent coal preheating connected with the use of selected binding additives /pitch, oil residues etc./ offer some further progress in widening the coal types suitable for coke making. However a "hard core" of heavy coking coal /about 30%/ remains as a necessary constituent in coal blends.

As concerns new coking processes, particularly those based on the cold or hot briquetting /"formed coke"/ there are still contradictory opinions on the reliability and feasibility. The present state is hardly better than in early 1960's when first pilot plants have been erected. BF tests with formed coke proved far outside of success. Prospects to change this picture in the 1980's are rather poor in contrast with more optimistic views of some professional research organisations.

Physico-chemistry of coal must be deepened by modern analytical control as a condition of the likely know how for the transition of the organic mass from "exidised" state that occurs in thermal coals into a more "reduced" state, typical for metallurgical coals. Radical breakthroughs for a large utilization of new coking processes based on non-metallurgical coals appear not likely in the medium-length term.

CONCLUDING REMARKS

Metallurgical coal will maintain its decisive role as a fuel and reductant in the steel industry. Basing on long-term experience one can believe that metallurgical coal will continue to be available in needed quantity and quality for all interested steel producing countries in the 1980's, and beyond. It is to believe also that a short-term tensions may arise and the availability may sometimes get close to demand due to lack of satisfactory consumers - producers coordination and some unpredictable events. In order to minimize the risk connected with above situations the long term policy should be applied by the exploration of captive coal deposits /directly or indirectly/ or by long term purchase contracts. Such an approach has always been welcomed and convergent with the expectations of coal producing countries.

Main insurance against the possible events is the diversification of the sources of supply. Because of the different characteristics of coal from various deposits a sophisticated expertise in coal blending and carbonization will be needed and can be assured by the assistance of industrialized countries. Joint efforts are needed to achieve the maximum possible coordination between the expected demand and coal mining capacity including capacity for coal upgrading, transport and carbonization. There is a large scope for improving international cooperation in the area of coal trade. The same applies to coal classification systems both national and international.

UNIDO has an important function in:

- analysing the metallurgical coal market, supply agreements and contractual policies;
- sharing and disseminating information on appropriate technologies in iron reduction processes, on coal/coke economy, on use of alternative reductants and their costs;
- advising developing countries on the technical and economical criteria to be examined before decisions were taken on new coal-mining and processing activities;
- undertaking systematic dialogue with industrialized countries with the aim to establish a better balanced situation in securing mutual interests arising with establishment of steel programs in developing countries.

This paper, is thought as a contribution in erecting a suitable basis for the decisions which now have to be undertaken.

Annex: tables 1-7

Table 1. TECHNICALLY AND ECONOMICALLY RECOVERABLE RESERVES /10^9 t/

Region/country	hard coal /bituminous and anthracite/	of which metallurgical[1] quality
USA	113,2	39,3
Canada	8,7	2,5
Western Europe	70,2	20,2
Australia and New Zealand	18,3	8,5
South Africa /Rep.of/	26,9	3,4
Japan	1,0	0,4
1. ME industrialized countries	238,3	74,3
2. CMEA countries	105,4	21,5
ME Asia	34,7	4,8
Latin America	5,9	1,2
Africa and Arab World	7,1	1,2
3. ME developing countries	47,7	7,2
T o t a l /1-3/	391,4	103,0
4. CP Asia	101,0	13,0
W O R L D /1-4/	492,4	116,0

1/ according to Survey of Energy Resources 1974; partly rapporteur's estimate

Source: The World Energy Conference; World Energy Resources IPC Science and Technology Press; UK, Guildford 1978.

Table 2. HARD COAL OUTPUT /10^6 ton/

Region/country	Facts 1970	1974	1978	1979	Prospects[1] 1985	1990
USA	536,9	539,1	609,0	703,7	800	900
Canada	11,6	17,8	25,4	28,0	35	40
Western Europe	319,5	246,0	251,0	250,9	230	210
Australia and New Zealand	44,3	58,0	81,8	83,1	100	115
South Africa /Rep.of/	54,6	64,6	90,3	103,4	160	200
Japan	39,6	20,3	19,0	17,6	15	15
1. ME industrialized countries	1006,5	945,8	1076,5	1186,7	1340	1480
2. CMEA countries	612,0	674,0	732,7	734,9	820	900
ME Asia	89,9	105,7	130,0	131,2	180	230
Latin America	10,2	10,4	13,5	15,2	23	30
Africa and Arab World	5,0	5,0	5,0	5,0	7	10
3. ME developing countries	105 1	121,1	148,5	152,4	210	270
T o t a l /1-3/	1823,6	1740,9	1957,7	2074,0	2370	2650
4. CP Asia[x/]	387,0	473,0	659,2	704,3	780	850
W O R L D /1-4/	2210,6	2213,9	2616,9	2778,9	3150	3500

1/ Rapporteur's estimate

x/ gross production /run of mine/

Source: Coal International vol. II N° 5, May 1980

Table 3. CRUDE STEEL AND PIG IRON PRODUCTION /10^6 ton/

	Facts				Prospects	
STEEL	1970	1974	1978	1979	1985	1990
USA	122,1	135,2	127,1	126,1	139	153
Canada	11,2	13,6	14,9	16,0	18	20
Western Europe	159,6	183,6	161,5	170,9	185	205
Australia and New Zealand	7,0	8,0	7,8	8,3	9	10
South Africa Rep.	4,7	5,8	7,9	8,8	9	10
Japan	93,3	117,1	102,1	111,7	125	139
1.ME industrialized countr.	397,9	461,3	421,3	441,8	485	537
2.CMEA countr.	155,9	185,0	211,1	210,1	235	260
ME Asia	10,8	17,0	23,5	26,7	36	45
Latin America	13,2	17,4	24,2	27,0	40	50
Africa,Arab World	0,8	1,1	2,2	2,1	4	8
3.ME developing countries	24,8	35,7	49,9	55,8	80	103
T o t a l /1-3/	578,6	682,0	682,3	707,7	800	900
4.CP Asia	17,8	26,7	35,7	38,4	50	60
W O R L D /1-4/	596,4	708,7	718,0	746,1	850	960
PIG IRON						
USA	83,3	89,3	79,5	79,8	88	97
Canada	8,4	9,8	10,3	11,1	12	14
Western Europe	112,0	131,2	107,1	117,1	127	141
Australia and New Zealand	6,1	7,5	7,3	6,8	7	8
South Africa Rep.	3,9	5,3	5,9	7,0	8	9
Japan	68,0	92,7	78,6	83,5	93	104
1.ME industrialized countr.	281,7	335,8	288,7	305,3	335	373
2.CMEA countr.	109,7	123,9	146,4	144,8	161	177
ME Asia	8,6	10,0	13,5	15,3	20	26
Latin America	8,6	12,0	19,0	19,7	29	36
Africa,Arab World	1,2	1,5	1,5	1,5	3	6
3.ME developing countries	18,4	23,5	34,0	36,5	52	68
T o t a l /1-3/	409,8	488,2	469,1	486,6	548	618
4.CP Asia	18,4	23,0	38,2	39,7	52	62
W O R L D /1-4/	428,2	511,2	507,3	526,3	600	680

1/ Rapporteurs estimate; assumed growth rate - industrialized countries 2,0%/yr; developing countries 5,0%/yr;

Source: Stahl und Eisen 100 /1980/ No. 8, 21 April

Table 4. METALLURGICAL COAL CHARGE FOR COKE MAKING /10^6 t/

Region/country	Facts 1970	1974	1978	1979	Prospects[1] 1985	1990
USA	87,1	75,0	65,5	69,5	73	75
Canada	6,0	7,0	7,4	8,1	10	12
Western Europe	129,8	115,4	90,0	93,0	95	95
Australia and New Zealand	7,3	8,0	8,4	8,0	9	10
South Africa /Rep.of/	8,0	8,2	8,4	9,0	11	12
Japan	60,1	63,8	,0	64,4	72	76
1. ME industrialized countries	298,3	277,4	242,7	252,0	270	280
2. CMEA countries	138,0	155,0	165,0	165,0	180	190
ME Asia	14,0	15,0	18,0	19,0	25	31
Latin America	5,0	8,0	10,0	12,0	18,	26
Africa and Arab World	0,4	0,4	0,4	1,0	2	3
3. ME developing countries	19,4	23,4	28,4	32,0	45	60
T O T A L /1-3/	455,7	455,8	436,1	449,0	495	530
4. CP Asia	na	na	na	na	na	na

1/ Rapporteur's estimate

Source: Annual Bulletin of Steel Statistics for Europe
Coal International - vol. II, ed. January-May 1980

Table 5. HARD COAL TRADE /10^6 t/

Country/region	Facts 1970	1974	1978	1979	Prospects[1] 1985	1990
Exports from:						
1.USA	65,1	55,1	37,0	60,0	70	80
2.Canada	4,0	10,8	13,6	13,3	20	30
3.Germany /FR/	22,8	17,4	19,0	15,2	15	15
4.Australia	18,3	29,4	38,7	40,3	50	60
5.South Africa /Rep.of/	1,5	2,3	15,4	23,3	40	50
6.CMEA	56,3	70,0	69,7	60,0	60	60
7.Others /incl.CPAsia/	3,0	5,4	5,6	7,9	15	25
T o t a l /1-7/	171,0	190,4	199,0	220,0	270	320
of which:						
"sea borne" trade	103,3	126,2	132,0	155,0	205	255
"intra bloc" trade	67,7	64,2	67,0	65,0	65	65
Imports to:						
1.Japan	50,2	64,2	52,2	58,5	80	110
2.Western Europe	68,1	71,9	79,8	91,3	110	120
3.Canada	17,1	12,4	13,6	16,4	15	15
4.USA	-	1,9	2,7	1,0	-	-
5.CMEA	28,5	32,0	31,8	33,0	35	35
6.ME developing countries	7,1	10,0	18,9	19,8	30	40
T o t a l /1-6/	171,0	190,4	199,0	220,0	270	320
of which:						
- metallurgical	101,2	116,2	109,6	110,0	130	140
- thermal	69,8	74,2	89,4	110,0	140	180

1/ Rapporteur´s estimate

Source: World Coal
Coal International - vol. II, editions January-May 1980

Table 6. METALLURGICAL COAL PRICES
/US doll./ton at current exchange rates/

Item	1970	1974	1977	1978	1979
US metallurgical coal cif ARA ports	18,70	58,80	61,00	62,00	62,00
Delivered coal cif Japan ports:					
heavy coking					
not over 8% ash	.	.	75,20	71,00	63,00
over 8% ash	.	.	64,30	63,90	53,50
soft coking					
not over 8% ash	.	.	63,80	59,00	52,80
over 8% ash	.	.	57,90	56,80	47,20
non coking /additive/			37,70	39,90	37,80
exchange rate at yearend: Yen/US doll.	.	.	250,0	194,6	239,7

Source: Coal International, vol. II N° 3, March 1980

Table 7. COAL TRADE OCEAN FREIGHT RATES, May 1980
/US doll./long ton/

US North of Hatteras or US Gulf to:	
Dunkirk - Hamburg Range	14,00/16,00
North Spain	14,00/16,00
Port Talbot or Redcar	14,00/16,00
Fos	12,00/14,50
Constanza	26,00/29,00
Alexandria	21,00/24,00
Lazaro Cardenas	12,00/14,00
West Coast Italy	14,00/16,00
Japan	25,20/27,50
Pohang	21,00/24,00
Newcastle, Port Kemble or Sydney to:	
Dunkirk - Hamburg Range	24,00/26,00
North Spain	24,00/26,00
West Coast Italy	24,00/26,00
Port Talbot or Redcar	24,00/26,00
US Gulf or US Atlantic	20,00/22,00
Japan	18,00/20,00
Vancouver, Roberts Bank to:	
Dunkirk - Hamburg Range	22,00/24,00
East Coast Canada /St.Lawrence River/	17,00/20,00
Japan	12,00/14,50

Source: Coal International vol. II N° 5, May 1980

UNITED STATES

COAL DEPOSITS

1. Recent data on US coal resources and reserves according to X World Energy Conference /1977/ are tabulated below:

Geological resources in 10^6 tce		Technically and economically recoverable reserves in 10^6 tce	
hard coal[1]	brown coal[2]	hard coal[2]	brown coal[2]
1190.000	1380.398	113.230	64.368

[1]bituminous coal and anthracite
[2]subbituminous coal and lignite

Source: World Energy Conference: World Energy Resources 1985-2020; IPC Science and Technology Press, Guildford, U.K. 1978

All above quantities are in deposits of the type /above 0,7 m thick/ and depth /max. 600 m/ considered amenable to present mining and economic conditions. Beyond this the US Geological Survey has identified coal deposits at depths not over 900 m containing not less than 1000 x 10^6 tce in place.

Coals in the Eastern States are generally of high rank and of lower ash content, than that in the Western States where low rank coals are prevailing. The overburden for the eastern coals is mostly composed of shales and sandstones being advantageous for underground workings. By contrast much of the coal in Western States is overlain with unconsolidated alluvial material not suitable for underground workings. These conditions along with the multibedded coals of relatively thick seams dictate open pit mining in the Western States.

Nearly all the anthracite reserves /2% of the total/ and four fifth of the bituminous coal reserves /54% of the total/ are lying east of the Mississipi River. Variations in the sulphur content have

a significant bearing on the future siting of mines and plants that will utilize coal.

Technically and economically recoverable reserves can be characterized by sulfur range as follows in percent:

Method of mining	sulfur range less than 1,0%	1,1-3,0%	more than 3,0%	unknown
underground	42	30	24	14
open pit	53	24	14	9
average	46	21	21	12

Source: Minerals Yearbook Edition 1976. US Dept. of the Interior; Bureau of Mines.

The sulfur content of nearly 1/8 of the reserves is unknown largely because many coal beds have not yet been mined.

2. Bituminous coal is the most abundant and widespread rank of coal presently mined in the United States. Nearly all the "western" bituminous coals have high coking properties. Some of them exceed after beneficiation the presently tolerable limit of 1,25% sulfur /on dry basis/ regarded suitable for metallurgical coals, but they represent a small minority. "Western" bituminous coals, with few exceptions, generally are non-coking i.e. thermal coals.

According to official data reported by IX World Energy Conference /Detroit 1974/ metallurgical coals represent one third of the recoverable hard coal reserves accounting for 39 billion tons as tabulated below:

Mining region	10^6 tce recoverable hard coal reserves	of which metallurgical quality	share percent
Appalachian	56.960	37.024	65
Eastern Interior	41.541	415	1
Western Interior	7.710	617	8
North Rocky Mountains	2.177	-	-
South Rocky Mountains	8.707	1.209	14
Pacific Coast	141	22	16
Alaska	454	-	-
Total	117.690	39.287	33,4

Source: IX WEC, Survey of Energy Resources 1974

Above presented figures seem to be underestimated bearing in mind:
a/ the severe standards and limits in cokability and purity between metallurgical and thermal coals still prevalent in this country;
b/ enlargement potential through better recoverability of deposits and more efficient coal beneficiation. A share such as 40% might be accepted as a more properly figure.

3. Recoverability of the US bituminous coals ranges from 40 to 90% according to the characteristics of coal bed, mining method and the legal restraints placed on. Mining experience has confirmed that on a national basis at least 50% of the underground in-place coal can be extracted.
Washability of the US bituminous coals is generally high and the optimum clean coal ash-low /6-7%/. Presently ratio: cleaned versus raw coal after beneficiation amounts to 73% on a national basis but higher results are likely in a not distant future.

MINING CAPACITY

4. The figures of US coal production in the last decade suggest that there is still an overhang of mining capacity by about 20% assuming 235 working days/year as a base against 195 days that were realized in 1977.
Productivity in US mining which improved steadily from early 1950's through 1969 declined in every year since. The output per man per day in underground mines fell from 12,1 tons /1970/ to 8,7 tons /1977/ or by 28% and in open pits respectively from 32,9 to 26,9 tons i.e. by 18%. Besides more stringent safety measures other factors have also contributed to the decline in productivity. These include an increase of wildcat strikes in recent years /particularly in 1978/, an influx of new, inexperienced miners and increased reclamation work.

In spite of these circumstances US coal has shown considerable short-term flexibility in gearing production to the changing demand at home and abroad, mainly due to large number /about 5500/ of small scale units /below 100 Ktons/yr/, yielding together nearly 20% of total output.

Salient data on US coal mining — forecast

Item	1970	1974	1975	1976	1977	1978	1979[1]	1980[1]
1.total production /mt/[1]	546,8	547,3	588,4	615,6	627,0	593,0	685	703
of which: hard coal[2]	536,9	539,1	557,9	598,5	597,2	569,4	655	670
2.number of active mines /-/	5601	3247	6168	6161	6200	na	na	na
3.average workers daily /thous/	140,1	166,7	189,9	202,3	214,8	na	na	na
4.productivity /net ton per man . day/	17,18	15,94	14,74	14,46	14,74	na	na	na
of which: underground	12,12	10,26	8,50	8,50	8,70	na	na	na
open pits	32,88	30,07	27,00	26,60	26,90	na	na	na
5.share of total output /%/								
underground	56,2	46,0	45,2	43,4	39,4	39	38	37
open pits	43,8	54,0	54,8	56,6	60,6	61	62	63

[1] Provisional figures by National Coal Association

[2] Bulletin of Coal Statistics for Europe

Source: Mineral Yearbook vol. 1 : 1976 Edition; also Coal International vol. I Nr. 8, Dec. 1979

8. The US coal industry is planning enough of new capacity to achieve the doubling of output during 1975-1990 as can be tabulated below:

./.

Estimated coal production by regions /megatons/

Region	facts 1975	prospects 1980	1985	1990
Northern Appalachia	148,2	148	166	180
Central Appalachia	186,6	244	270	292
Southern Appalachia	21,9	22	23	23
Midwest	126,3	87	141	158
Subtotal East	483,0	501	600	653
Central East	9,8	9	9	10
Gulf	10,0	15	15	19
Northern Great Mains East	8,0	12	28	41
Northern Great Mains West	44,6	153	257	419
Rockies	13,8	15	17	19
South-West	14,6	19	19	20
North-West	3,9	1	4	4
Alaska	0,7	.	.	.
Subtotal West	105,4	224	343	532
TOTAL production	588,4	725	943	1185
of which: hard coal[1]	557,9	670	800	900

[1] experts estimate

Source: "1976 National Energy Outlook" Doc. Federal Energy Administration FEA-N-75/713; Washington, March 1976

The US Administration objective announced in 1978 to raise total coal production to 1090 mt by 1985 seems not realistic. The increase in coal-fired power stations will lead to a higher production of subbituminous coal and lignite from open pits feeding nearby plants in Western Regions.

The reliability of this goal hinges on the timely resolution of principal factors such as:

- Standards i.e. lessening of environmental and operational criteria;
- prospecting i.e. Western Federal Lands opened in good time for surface mining /a lead time of 3-4 years for open pit resp. 6-7

years for underground mine capacity 2-5 mtons /yr/;

- stability i.e. long term internal energy policy should be promulgated;
- rentability i.e. adequate coal price to encourage private investments.

The uncertainties of the future US coal growth remain therefore still great enough.

6. To reach total output of 1185 megatons by 1990 /of which hard coal output 900 mt/ would require the development of 840 mt/yr of new capacity over the 1975 figure. This would mean the development of new capacity:

- eastern regions: 340 mt/yr /80% underground, 20% open pit/, yielding bulk of hard coal output;
- western regions: 500 mt/yr /100% open pit/ on low rank coal deposits.

Total investments for the above mine development have been estimated by the US Bureau of Mines as high as 24 billion in 1974 constant dollars. They exclude transport facilities beyond the pithead, extension of power grid to mine entrance, miners housing and other similar expenses that may be substantial. Mining investments per ton of net annual output have been adopted over life of mine as follows /in constant 1974 dollars:

- underground 31.40 doll/ton
- open pit 16.60 doll/ton.

To realize above mentioned programme about 125 thousand new coal miners would be additionally recruited and trained of which some 80 thousand in the eastern regions and 45 thousand in the western ones.

The course of development of the US coal industry over the next few years will be largely determined by the requirements regarding pol-

lution and land conservation, and the extent to which these are related to permit early expansion. Expansion will be mainly concentrated in the Western States /surface mined low rank thermal coal/ while the established deep mining in the Eastern States /metallurgical coal/ remains relatively stagnant.

COAL USE

7. The main stimulus in shaping of US mining capacity until now is internal coal demand. The disruption of oil supplies as well as soaring oil and gas prices added a new and strong motivation for growing coal demand, particularly for electrical energy generation. Foreign trade that presently absorbs no more than 7-8% of output remains only as a factor of secondary importance for US mining programms.

Electric power utilities are now accounting for nearly 4/5 of total internal coal use. Coal consumption in this sector augmented by 68% /1979/ against the relevant figure in 1970. The balance is utilized in nearly equal shares for coke making and other industrial purposes. An down trend in coal use by the above mentioned sectors is visible.

Salicut data on US coal use /megatons/

Item	1970	1974	1975	1976	1977	1978	1979[1]	1980
electric power	289,3	353,8	366,4	385,0	412,5	434,5	479,8	503
coke plants[2]	87,1	81,4	77,1	73,0	70,5	65,5	68,9	68
other	91,3	66,1	66,2	63,0	62,0	60,4	60,8	66
total /internal use/	467,7	501,3	509,7	521,0	545,0	560,4	609,5	637
coal exports	65,1	55,0	60,2	54,5	49,3	37,0	53,5	56
coal imports	0,5	1,9	0,8	1,1	1,5	2,"	1,5	2
Grand total	533,3	558,2	570,7	576,6	595,8	600,1	664,5	695
Share of total use /%/								
- electric power	61,8	70,6	71,8	73,3	75,0	77,4	78,8	79,0
- coke plants	18,6	16,2	15,1	13,9	12,8	11,5	11,3	10,7
- other	19,6	13,2	13,1	12,8	12,2	11,1	9,9	10,3

[1] provisional figures by National Coal Association
[2] including beehive ovens

Source: Mineral Yearbook vol. I, 1976 Edition; Coal International Vol. I No. 8, Dec. 1979

8. About 9/10 of US oven coke is produced in 48 so called "furnace plants" affiliated with steel industry. The balance is produced in 14 "merchant plants".

Since 1970 capacity has declined by 15 mt/yr, i.e. 25%. A federally founded study released by Economic Development Organisation /on Nov. 1, 1979/ concludes that US faces a critical situation in respect to a shortage of coke in the next 3-5 years. The Report lists the main causes of the lack of coking capacity:

- the age and obsolescence of coke plants /60% capacity above 20 years old/;
- escalating costs deriving from environmental protection and occupational safety measures;
- the enforcement of environmental restrictions in certain areas on the construction and replacement of coke ovens.

Capital investments per 1 mt/yr of coking capacity more than doubled in the last decade. They range between 180 and 200 million US current dollars as compared with 75-85 million dollars in 1970. About 25% of the total investment represent costs required for pollution control and occupational safety. US steel industry must now import growing tonnage of coke, mainly from EEC countries, where coke stockpiles are still high enough.

Salient data on US coke /Ktons/

Item	1970	1974	1978	1979[1]	1980[1]
coke production	60.338	55.854	45.153	46.000	46.000
exports	2.247	1.159	619	1.200	.
imports	138	3.210	4.895	3.900	4.000
stocks at producers	3.730	843	2.894	2.700	.
consumption:					
blast furnaces	52.705	53.005	47.436	47.600	47.500
other purposes	4.585	5.125	3.728	3.700	3.500
Total consumption	57.290	58.130	51.164	51.300	51.000
pig iron produced /mt/	85,1	89,3	79,5	80,0	80,0
steel produced /mt/	119,3	132,2	123,8	125,0	125,6
ratio coke/pig iron kg/t	633	609	597	595	590

1/ preliminary figures

Source: Mineral Yearbook 1976 Edition; Coal International vol. 1: No. 8, Dec. 1979

COAL EXPORT AVAILABILITY

9. The size and quality of its coalfields together with extensive loading capacity will make US mining probably the biggest future source of metallurgical coal for foreign markets. Metallurgical coal represents in average about 80% of total exported tonnage, the balance being thermal coal sold chiefly to Canada and West Europe. Peak tonnage /65,1 mt/ was exported in 1970. In following years exports oscillate on lower level according to conjunctural fluctuations in the main steel producing areas of market economy. Forecast made by National Coal Association suggests for 1980 some gains in export quota of metallurgical coal over figures from last preceding years.

Salient data on US coal exports /megatons/

Item	1970	1974	1975	1978	1979[1]	1980[1]
hard coal exports	65,1	55,4	60,1	37,0	53,5	50
of which:						
metallurgical quality	48,8	46,8	46,5	27,7	43,5	42
shipped to:						
- Canada	6,9	7,0	6,5	5,5	6,0	6
- Europe	16,4	12,5	12,7	10,5	18,3	16
- Japan	22,9	24,8	23,1	8,2	12,7	14
- Latin America	2,7	2,4	3,8	2,5	4,0	4
- others	-	0,1	0,4	1,0	2,5	2

[1/] provisional figures by National Coal Association.

Source: Mineral Yearbook Vol. I, 1976 Edition; Coal International vol. I No. 8, Dec. 1979

10, US metallurgical coal is known for its high cokability. To secure the suitable coke quality from blends containing weakly softening or non-fusible indigenous coals - especially in developing countries - some critical content of US coal as "hard core" constituent seems unavoidable. A full replacement of US coal in favour of domestic and/or imported coal from other destination is hardly to expect in nearly all cases where steel industry must rely on coal imports. Assessing the problem from the angle of the future coke needs abroad, coke quality needed, geography of coke making and use and being aware of the worsening conditions on hard coal deposits in Western Europe about 40% at least of the traded coal tonnage in the mid 80's ought to consist of US coal deliveries. It means the level of about 56 mt of US metallurgical coal as a reasonable figure needed on the world market by 1990.

Some constraints against the growth of US coal exportavailability can arise through growing internal demand in metallurgical coke. Owing to transport proximity this internal demand includes both US and Canadian steel industry.

The US steel industry obtains over 2/3 of its metallurgical coal /1979- 49 mtons/ from "captive mines" and buys the balance /20 mt/ yr/ from external mining Companies. Further 6 mt/yr metallurgical coal buys Canada from the same US "external mines" owing to transport proximity via Great Lakes route. Assuming further growth of the US steel output at a rate 2%/yr to 153 mtons and that of Canada's to 20 mtons by 1990 the metallurgical coal demand will rise by about 15 mt/yr over the present internal consumption. This additional demand can be met by increasing US "captive" capacity or/and by incorporation of US "external" mining companies. In the latter case this quantity would no longer be available for overseas export provided that no additional capacity in Eastern mining regions has been introduced in the meantime.

C A N A D A

COAL DEPOSITS

11. Recent data on Canada's coal resources and reserves according to WEC /1977/ are:

geological resources in 10^6 tce		technically and economically recoverable reserves in 10^6 tce	
hard coal	brown coal	hard coal	brown coal
96.225	19.127	8.708	673

Source: see para. 1

Reserve estimates are based on seams above 1,5 m thick to a depth of 1200 m. Main reserves are located in Provinces Alberta and British Columbia. Coal rank improves from east to west offering a great diversity in ash and volatile content.
Metallurgical coals are in majority petrographically inhomogenous with higher ratio of inertinite than US coals. Those in north-eastern British Columbia are lower in ash content than remaining ones and can be satisfactorily upgraded to 6-7% ash with acceptable recovery. Sulfur content is generally low ranging from 0,4 to 0,7%. The coalbearing strata are highly folded and faulted. Individual seams avaraging 2,5 to 3 m are often locally thickened to as much as 12 to 16 m at Smoky kiver and at Grassy Mountain. Most coal formations are partially eroded. Complex geology, high elevations, long rail hauls, adverse climatic conditions - all contribute to more costly than in US coal operations in this country.

12. According to official data reported by IX World Energy Conference /Detroit 1974/ metallurgical coals represent one fourth of the recoverable hard coal reserves accounting for 2,5 billion tons as tabulated below /megatons/:

Mining region	recoverable hard coal reserves	of which metallurgical quality	share percent
British Columbia	3.613	2.348	65
Alberta	507	182	36
New Brunswick	7.256	-	-
Total	11.376	2.530	23

Source: Survey of Energy Resources; IX WEC, Detroit 1974

Above presented figures seem to be rather conservative. Data do not include coal North of latitude 60°.

MINING CAPACITY

13. Canada's hard coal output doubled during the last decade, mainly due to growing shipments of metallurgical coal to Japan from 11,6 mt /1970/ to 25 mt /1979/. Nearly 50% of output consists of metallurgical coal. Six mining companies use surface, underground and combined techniques. Hydraulic mining introduced at Kaiser Resources Ltd.'s Sparwood operation has proved successful in a thick steeply dipping seams. Only 20% of output comes from underground operations, the balance being surface mined. Productivity in Canadian mining is less than in US mining. It averages about 6 tons in underground workings and 12 tons in open pits per man and day. In recent years coal mining has been only moderately profitable and the high cost mines in Nova Scotia have been subsidised. Below saleable hard coal output in mtons:

1970	1974	1975	1976	1977	1978	1979[1]	1980[1]
11,6	17,8	19,0	20,8	23,0	24,4	25	25

[1] privisional figures.

Source: Annual Bulletin of Coal Statistics.

14. New mining capacities are being planned and feasibility studies are reportedly well advanced for two underground developments on metallurgical coal /capacity 3 mt/yr/ in British Columbia and one open pit project on thermal coal /capacity 2,5 mt/yr/ in Alberta.

The official Federal Policy is to increase coal production at a rate of 7% annually to conserve oil in power stations, to promote metallurgical coal exports and to make the West Canadian coal competitive with US coal, in the East Canada. This objective seems no more realistic because the overall social climate for coal mining activities is far from being favourable. Opinions are contradictory and a long term strategy for the development of coal resources is not yet formulated. Presently published programs towards coal development in British Columbia and Alberta must be regarded as restrictive in seeking a balance between environmental protection and coal internal use.

Because of geographical location and high transportation costs Western Canadian thermal coal will be long unable to compete with US thermal coal supplied to Eastern Canada. The same is true as regards to shipments of US metallurgical coal in securing of Canada's steel industry located in Ontario.

Canada's metallurgical coal output will be largely determined by Japanese market. At the present time contracts are of the order of 10-12 mt/annually. This market seems assured so long as Japan is able to maintain its present steel capacity for internal demand and for export.

Assuming some additional markets for Canadian metallurgical coal will materialize /mainly in Latin America/ - following forecasts are considered realistic /mtons/:

	1980 facts	1985 prospects	1990
hard coal output	25	30	40
of which:			
metallurgical	15	20	30

15. Recent data on investment intentions were submitted by the Government of Canada to the ECE/Coal Committee in April 1979. In line with the above outlined figures about 2,0 billion C dollars should be spent for the existing and new mining capacity in the period 1978-1990 of which in:

metallurgical coal capacity - 1,7 billion dollars
high rank thermal coal capacity- 0,3 billion dollars.

Further investments /2,3 billion/ are scheduled for development of low rank thermal coal mines /brown coal and lignite/. More detailed data are tabulated below:

Investment intentions in Canada's mining industry
/million dollars at 1977 exchange rate/

	1978-1980	1981-1985	1986-1990
1. Metallurgical coal:			
existing capacity	24	179	-
new capacity	68	587	670
replacement of equipment	-	-	194
subtotal /1/	92	766	864
2. high rank thermal coal			
existing capacity	54	152	-
new capacity	-	-	-
replacement of equipment	-	30	100
subtotal /2/	54	182	100
3. low rank thermal coal:			
new capacity	115	410	660
replacement of equipment	318	390	435
subtotal /3/	433	800	1095

Source: Doc. COAL/GE.2/R33/Add 1; 26 April 1979.

COAL USE AND EXPORT AVAILABILITY

16. Canada has now outbalanced its hard coal trade as outlined below /mtons/:

hard coal	1970	1974	1975	1976	1977	1978	1979[1]	1980[1]
imports	17,1	12,4	15,2	14,6	15,3	15,0	15,0	15
exports	4,0	10,8	11,7	11,8	12,3	13,6	13,5	14

1/ provisional figures

Source: International Coal Trade; various issues

Bulk of the imported US coal is carbonized in four integrated steel plants from which three biggest ones are located in Ontario and one in Nova Scotia. Present coke rate is about 510 kg per ton of pig iron. Canada's coking capacity amounts to about 6,3 mtons/yr of which:

Algoma Steel Corp. Ltd. ..... 1940 ktons/yr
Steel Company of Canada ..... 2370 ktons/yr
Dominion Foundaries and Steel Ltd. ..... 1250 ktons/yr
Sydney Steel Corp. ..... 630 ktons/yr

Source: The Northern Miner /Toronto/, Nov. 25, 1976.

17. Bulk of exported metallurgical Canadian coal is destined for Japan. A trend for diversyfying of customers and seeking additional markets in Western Europe, Latin America and Eastern Asia is quite distinct in last years:

Destination of Canada's coal exports /mt/:

	1978	1979[1]
Japan	11,4	11,0
Western Europe	1,2	1,2
Latin America	0,5	0,5
Others	0,5	0,8
Total	13,6	13,5

1/ provisional figures

Source: Coal International Vol. II No. 1, January 1980.

Canadian metallurgical coal exports, like those of other coal exporting countries are expected to be higher in 1980's as economic conditions throughout the market economy area improve. Export figures such as:

by 1985 - 20 mtons
by 1990 - 25 mtons

can be regarded as realistic, provided that buyers market will be firm.

WESTERN EUROPE

COAL DEPOSITS

18. The location and size of the coalfields in Western Europe is identical by virtue with those of the European Economic Community /EEC/. Supplementary deposits are those located in Spain and in Spitsbergen of minor importance.

The major and most perspective regions of hard coal mining are Ruhr-coalfield in Germany/FRG/ and Midlands and Yorkshire-coalfields in United Kingdom. French deposits in Lorraine are the continuation of the Saar basin in FRG.

Recent data on coal resources and reserves are following:

	Geological resources 10^6 tce		Technically and economically recoverable reserves /10^6 tce	
	hard coal	brown coal	hard coal	brown coal
Germany /FR/	230.300	16.500	23.900	10.500
United Kingdom	163.576	-	45.000	-
France	3.326	42	437	11
Belgium	263	-	137	-
Spain	1.786	512	322	218
Total Western Europe	399.251	17.054	69.796	10.729

Source: as in para. /1/.

Above figures relate to deposits over 0,7 m thick to a 1200 m depth. Mining conditions are very complex. All hard coal must be underground mined. Coal seams are relatively thin and must be exploited at great depth - in average 800 m. It results from the long period of intensive mining activity in past decades.

Hard coal in this area range over all degrees of rank from anthracite to high volatile ones. The greater part, particularly from Ruhr basin is well suitable for coking. Sulfur content ranges usually around 1,0% after cleaning to 6-8% ash. Best deposits of metallurgical coal have been heavily depleted, particularly in U.K.

19. The occurrence of coking coal basis has been a main factor that stimulated the growth of steel industry in Western Europe. According to data recorded by IX WEC /Detroit 1974/ roughly one third of economically recoverable reserves i.e. 20 billion ton is regarded as of metallurgical quality, of which 90% is concentrated in RFG's coalfields:

Mining region	recoverable hard coal reserves mtons	of which metallurgical quality[1]	share /%/
Ruhr		15.600	
Saar		1.680	
Aachen		540	
Niedersachsen		180	
1.Subtotal Germany /FR/	23.900	18.000	75
Central England		993	
Northern England		355	
Southern Wales		254	
Scotland		35	
2.Subtotal U.Kingdom	45.000	1.637	4
Lorraine		308	
Nord Pas de Calais		31	
Centre Midi		11	
3.Subtotal France	437	350	80
4.Subtotal Spain	322	226	70
GRAND TOTAL /1-4/	69.659	20.213	30

[1] Figures according to Survey of Energy Resources; IX WEC /Detroit 1974/.

MINING CAPACITY

20. Mining capacity is on a steady declining trend experienced over the last 20 years. Today's capacity represents only half of that existing in early 60's. Each of the major coal producing countries in Western Europe has recorded a fall in output during the first half of 1970's. Since then the extraction potential is stabilized on the level of 250 mt/yr., in line with the average productivity of 2,2 ton output per man per day.

In 1978 the annual EEC mining potential /Spain not included/ was set at 252 mtons compared with 273 mtons in 1974.

On the basis of announced plans and projects underway this potential will probably diminish to 237 mtons in 1982. The EEC coal mines are thus falling farther behind the annual production target of 270 mtons which was set by the "Medium-term Guidelines for coal 1975-1985" and adopted by the Council of Ministers in Brussels.

Investments in the Community coal industry in 1978 reached a level of 978 mln EUA /European Units of Account; 1 EUA = 1,274 US doll. 1978/. Capital expenditures rose again to over 1 billion EUA in 1979 as the result of new mining projects substituting presently uneconomic capacities.

EEC - Data on capital expenditures and mining capacity

Coalfield	Expenditures millions EUA 1978	Expenditures millions EUA 1979[1]	Mining capacity megatons/year 1978	Mining capacity megatons/year 1982	Productivity ton/man/day 1978
Ruhr	140,1	204,6	80,1	77,6	
Aachen	16,9	16,7	5,6	5,6	
Saar	37,9	75,5	10,8	11,0	
Niedersachsen	15,2	13,2	2,5	2,4	
Germany /FR/	210,1	310,0	98,9	96,6	3,48
Scotland	23,6	28,2	9,0	7,8	
Northern	48,9	52,1	13,2	11,6	
Yorkshire	322,9	275,2	32,6	33,9	
Midlands	179,6	162,2	37,7	35,6	
Western	48,7	51,2	11,6	10,0	
South Wales	57,6	38,0	7,8	7,5	
Opencast	18,5	16,3	14,0	10,7	
United Kingdom	699,3	623,1	126,0	117,1	2,52
Nord/Pas de Calais	6,2	5,4	6,0	2,9	
Lorraine	37,5	31,7	9,8	10,5	
Centre-Midi	4,9	4,4	4,0	3,1	
France	48,7	41,5	19,8	16,5	1,72
Kempen	19,6	30,7	6,0	7,0	
Basin du Sud	0,4	0,1	1,0	-	
Belgium	20,0	30,8	7,0	7,0	1,80
EEC - TOTAL	978,0	1005,4	251,7	237,2	2,27

[1/] provisional figures

Source: Coal International Vol. I no. 8, Dec. 1979.

21. Hard coal production in Western Europe dropped by 70 mtons/year during the last decennium. United Kingdom and Germany /FR/ contribute to 85% of coal output in this area:

Hard coal production in Western Europe /mtons/

	1970	1974	1975	1976	1977	1978	1979[1]	1980[1]
Belgium	11,4	8,1	7,5	7,2	7,0	6,6	6	6
France	37,3	22,9	21,5	21,8	21,3	19,6	19	18
Germany /FR/	111,3	94,9	92,4	89,3	90,8	90,1	92	92
United Kingdom	144,6	109,3	120,0	122,3	120,6	121,7	122	122
Spain	10,7	10,8	11,0	11,2	11,9	12,8	12	12
Total	319,5[2]	246,0	252,4	251,8	251,6	250,8	251	250

[1]/provisional figures
[2]/Netherland's production included /4,2 mt/
Source: Annual Bulletin of Coal Statistics.

Manpower in the West European coal mining dropped parallel to the output from 615 thousand /1970/ to 458 thousand /1978/ of which in Belgium from 39 to 15, in France from 98 to 58, in Germany /FR/ from 176 to 125, in U.K. from 254 to 214 and in Spain from 48 to 46 thousand.

22. Production costs at pithead per ton of net output are generally very high, particularly in FRG, Belgium and France. Most recent data submitted by Governments to the ECE/Coal Committee relate to 1976 being calculated in US dollars on current exchange rates. These costs amounted to:

Belgium	81,3 doll/ton	of which manpower 48,3 doll.
France	56,3	35,6
Germany FR	60,9	32,3
U.Kingdom	33,0	17,8

Source: Doc. COAL/GE.2/R.33/Add.3; 25 April 1979.

Since then mining costs increased further sharply. To survive - EEC mining industries are highly subsidized. Western Europe remains a highest cost area in world coal mining.

23. Most of the ECE coal producers are reluctant to commit the very large amount of capital required for long term developments. Among constraints to increase production some principal factors should be taken into account such as the age of the pits, manpower and environmental problems.

Present operating pits are rarely of the size required for optimum economy. The remaining reserves are insufficient to bear the investment cost or have natural conditions against high productivity. In the old coalfields there are few remaining reserves big enough to permit the development of a new colliery of economic size.

Recruitment of manpower is difficult.

Land conservancy issues may in some cases restrict the growth of mining capacities.

According to official declarations the United Kingdom will maintain its present production /120 mt/yr/ through to 1990, mainly from the new Selby coalfield. Germany /FR/ declares similar intentions in maintaining the present level /90 mt/yr/. France, Belgium and Spain intend to run its hard coal mining down mainly because of difficult manual work conditions which become unacceptable.

Summing up - the reasonable target for hard coal output in Western Europe could be as high as:

by 1985 - 230 mtons/yr, of which metallurgical about 80 mt/yr;

by 1990.- 210 mtons/yr, of which metallurgical about 70 mt/yr.

FRG's metallurgical coal must be regarded as non-existent for the open market. German Steel Industry itself looks for overseas investments in coal mining to secure its future demand under more favourable conditions.

COAL USE

24. Western Europe is a net coal importing area, despite the extensive "intrablock" trade with FRG as significant coal exporter. Net imports from third countries run on upward trend both for coke making as for electrical power generation reaching now a level of 60 mtons/yr of which /1979/:

metallurgical coal - 22 mt/yr
thermal coal - 38 mt/yr.

Imported coal is now much cheaper to obtain /including transport costs/ than domestic in the reviewed area.

Internal hard coal consumption in Western Europe dropped against 1970 figure by 65 mtons/yr mainly due to competitivity of hydrocarbon fuels in communal sector as well by decreased coke demand outside steel industry. Oil crisis has reversed this trend giving impetus to growing coal use mainly for electric power generation, particularly in coastal works accessible for coal supplies on waterways. Demand for metallurgical coal will likely change insignificantly over present figure of 93 mtons /1979/, while that for thermal coal has good perspectives to rise at growth rate experienced since

1 This means followinglikely picture as tabulated below:

Western Europe - hard coal use /mtons/

Item	1970	1978 facts	1979[1]	1980[1] prospects	1985[2]	1990[2]
1.power plants	132,8	150,0	155	158	170	185
2.coke plants	129,8	90,0	93	93	95	95
3.other	112,4	65,0	62	59	55	50
4.total internal use	375,0	305,0	310	310	320	330
5.hard coal output /rounded figure/	320,0	250,0	250	250	230	210
6.Difference /4-5/ to be imported of which:	55,0	55,0	60	60	90	120
for power plants	25	30	34	35	65	90
for coke plants	15	20	22	22	25	30
for other purposes	15	5	4	3	-	-

[1]/ provisional figures; [2]/ Rapporteur's estimate

Source: Annual Bulletin of Coal Statistics for Europe.

25. Coke production and consumption dropped by 25% during the last decade despite of the revival of economic activity after the slump in 1975-77. Specific coke rate which averaged in this area about 560 kg/ton pig iron /1970/ dropped to 500 kg/ton /1979/ lying presently at:

Belgium-Luxemburg ..... 525 kg
France ..... 490 kg
Germany /FR/ ..... 480 kg
Italy ..... 465 kg
Netherlands ..... 445 kg
United Kingdom ..... 590 kg

Coking capacities are still underutilized by nearly 20%. This relates particularly to those located at collieries.

Western Europe salient data on coke production and coking capacity

Country	coke production mtons				coking capacity mtons/yr 1979			
	1970	1974	1978	1979[1]	steel-works	collie-ries	inde-pend.	total capacity
Belgium	6,7	6,5	5,7	6,0	7,5	-	0,1	7,6
France	14,1	14,0	10,3	11,1	6,7	6,0	-	12,7
Germany /FR/	39,9	34,9	25,4	25,4	9,6	22,2	-	31,8
Italy	6,0	7,2	7,2	7,8	9,0	-	2,6	11,6
Netherlands	4,0	3,0	2,9	2,6	2,5	-	0,5	3,0
United Kingdom	20,3	16,7	12,2	13,5	11,3	3,3	3,0	17,6
other W.Europe	6,2	6,3	6,3	6,6	7,6	-	0,8	8,4
Total	97,2	88,6	70,0	73,0	54,2	31,5	6,9	92,7

[1] preliminary figures
Source: Annual Bulletin of Coal Statistics.

This picture can change quickly since coke plants at collieries are obsolete. It is expected that the majority of them will be closed down. Some new capacity will be needed through 1990, otherwise coke shortage would arise despite of sufficient coal availability.

A U S T R A L I A

COAL DEPOSITS

26. Australia's coal resources and reserves according to X WEC /1977/ amount to:

geological resources in 10^6 tce		technically and economically recoverable reserves in 10^6 tce	
hard coal	brown coal	hard coal	brown coal
213.760	48.374	18.128	9.225

Source: see para. 1

Above reserve figures relate to deposits of the type /over 1,5 m thick, less than 30% ash on dry basis/ and depth max 600 m.
Main deposits of hard coal are located in Bowen Basin /Central Queensland/ where surface mining prevails /about 80%/ and in Sydney Basin /New South Wales/ where underground mining is prevalent /about 85%/.
Mining conditions are exceptionally favourable. Coal seams are horizontal, varying in thickness from 2,4 to 3 m in underground workings and from a few meters to 100 meters in open pits with overburden ratio less than one cubic meter/ton of coal output.
Washability of hard coals /in Australia the term "black coal" is used/ is rather poor but ash content averaging 9% can be obtained with tolerable recoverability after beneficiation.
Taking into account the short period of coal exploration - the potential for enlargement recoverable reserves must be regarded as high.

27. The rank of most Australian "black coals" is generally lower than those in USA, Canada and Western Europe. Most of them are middle rank coals of high volatility /35-40% on daf basis/, free swelling index ranging between 4 to 6 units and of low dilatation. Sulfur content is low /0,5%/. Australian metallurgical coals must

be blended with "premium grade" coals of higher rank to obtain satisfactory coke. According to official data reported by IX WEC /Detroit 1974/ metallurgical coals represent more than half of the recoverable hard coal reserves accounting for 8,5 billion tons as tabulated below:

mining region	recoverable hard coal reserves[1]	of which metallurgical quality	share percent
Bowen Basin /Queensland/	8.725	6.228	71
Sydney Basin /New South Wales/	5.045	2.309	58
	13.770	8.537	62

[1]/IX WEC figures /Detroit 1974/

Potential for enlarging metallurgical coal reserves is high.

MINING CAPACITY AND EXPORT AVAILABILITY

28. Favourable mining conditions permit high productivity in Australian "black coal" mines /data for fiscal year 1977/78/:

underground	- 10,06 tons/man/day
surface	- 30,16 tons/man/day
all mines /average/	15,24 tons/man/day.

Ratio of output from underground and surface mines is at present near 50 : 50%. Working hours in Australian mines have been reduced from 40 to 35 a week. Number of workers is now of 24 thousand. The estimated operating cost in 1974 constant currency is reportedly for hard coal:

- in Sydney Basin /mainly underground/ - 8,50 A.doll./ton
- in Bowen Basin /mainly open pit/ - 6,80 A.doll./ton.

The capital cost per ton of annual output is considered to be of the order of doll. A. 32 as an average figure for mine investments. Not included are costs of railway, power grid and seaport capacity. Six new mining projects are in advanced planning and in meantime partly

realized. Only one of these projects relates to deep extraction - the remaining five belong to category of surface undertakings. All the projects are oriented towards coal export with totalled capacity of 26 mtons/yr and preliminary cost of 2 billion A. dollars in 1974 currency.

Australia - new mining projects

Project/ location	Company	annual capacity mtons/yr	preliminary cost mill.A.dol.	coal type
1.West Cliff Colliery /N.S.Wales/	Broken Hill Mining	2,0 /D/	50	metallurgical
2.Blair Athol /Central Queensland/	Blair Athol Coal Pty.Ltd. Thiess Peabody Mitsui and Hail Creek Associates	6,0 /S/	n.a.	thermal
3.Nebo /Queensland/	Thiess Peabody Mitsui	5,5 /S/	639	metallurgical
4.Hail Creek /Queensland/	Associated Australian Resources	4,5 /S/	700	metallurgical and thermal
5.Norwich Park /Queensland/	Utah Development Co.	4,3 /S/	240	metallurgical and thermal
6.Warkworth Hunter Valley /N.S.Wales/	Costain Australia LTD.	4,0 /S/	n.a.	metallurgical and thermal
Total		26,3 ab.	2000	

D - deep mining; S - surface mining.
Source: World Coal Vol. 2 No. 11, Nov. 1976

29. During the last decade Australian hard coal saleable production nearly doubled. The same relates to coal exports of which about 3/4 are going to Japan.

Australia - Hard coal production and exports /mtons/:

	1970	1974	1975	1976	1977	1978	1979[1]	1980
saleable production	44,3	58,0	60,7	67,8	70,8	76,0	78	80
exports	18,3	29,4	29,9	34,1	36,2	38,7	40	40

1/preliminary figures.
Source: Coal International vol. 1 No. 6, October 1979

Total hard coal exports from Australia during the past five fiscal years by country of destination are shown in the accompanying tabulation /Ktons/:

Destination	1973/74	1974/75	1975/76	1976/77	1977/78	1978/79
Japan	23.872	24.148	23.840	27.319	26.289	25.174
Western Eur.	3.423	6.802	5.722	6.517	8.136	8.776
Others	1.092	1.472	863	1.536	3.486	4.328
Total	28.387	32.422	30.425	35.372	37.911	38.278

Source: Joint Coal Board /Sydney/, June 1979

Of the total exports in fiscal year 1977/78 roughly 32 mtons were of metallurgical quality and 6 mtons of thermal coal.

30. Australia is well endowed with natural gas, oil and nuclear minerals and is therefore not under such pressure to expand its coal industry as are other countries. Internal hard coal consumption is relatively stable allowing no much room for further expansion in the next decade. Hard coal internal consumption during the past fiscal years shows increase only for electric power generation.

Australia - internal consumption of hard coal /Ktons/

Consumer group	1970/71	1973/74	1974/75	1975/76	1976/77	1977/78	1978/79
power plants	11.520	14.787	16.253	16.454	19.668	20.482	21.032
coke plants[1]	7.332	8.981	9.606	8.854	8.364	8.284	8.738
other	3.278	3.915	4.331	4.146	4.156	3.789	3.671
total consumption	22.130	27.683	30.190	29.454	32.188	32.555	33.431

[1/] coal as received

Source: Joint Coal Board /Sydney/, June 1979.

Internal hard coal market will remain relatively modest bearing in mind the small population and the possibility to make a broader use of the domestic lignites for power generation.

31. The present Federal Government policy is rather restrictive against foreign investments in energy industries. If the capital

required to expand the coal industry has to be raised chiefly from Australian sources it would retard expansion. Since 1976 some export levies on metallurgical coal have been imposed.

If the new mining projects successfully materialize /see para.28/ - a growth on a rate 3-4%/year seems to be secured. This means a hard coal saleable output

- by 1985 - 100 mtons/yr; export availability 50 mtons/yr
- by 1990 - 115 mtons/yr; export availability 60 mtons/yr.

Assessing the future export availability in terms of metallurgical quality and of the reasonable transport costs to the consumers a steady inflow of 40-45 mt/yr of Australian metallurgical coal to the world market by mid 1980's seems a realistic forecast.

S O U T H A F R I C A /Rep. of/

COAL DEPOSITS

32. South African coal resources and reserves according to X WEC /1977/ are:

geological resources in 10^6 tce		technically and economically recoverable reserves in 10^6 tce	
hard coal	brown coal	hard coal	brown coal
57.566	-	26.903	

Source: see para.1.

Above reserve figures relate to deposits on a depth of max. 300 m. Main producing coalfields are in the Transvaal /68% of actual capacity/, Oranje Free State /20%/ and Natal Province /12%/. Mining conditions are favourable. For the most part the seams are flat, undisturbed and at shallow depth.

33. South African hard coal is generally of low rank, well suited to power generation. Higher rank coal of metallurgical quality occurs scarcely and must be blended with "premium grade" coking coals. According to estimates made by the "Commission of Inquiry into the coal resources" /short Petric Report 1975/ the existence of 3,4 billion ton of recoverable metallurgical coal is secured.

South Africa - Petric Report data on metallurgical coal /mtons/:

hard coal recoverable reserves	of which: metallurgical quality	share /%/
24.981	3.451	14

Washability of South African coals is poor and imposes serious requirements on the upgrading procedures.

MINING CAPACITY AND EXPORT AVAILABILITY

34. Surface mining had not until recently been widely adopted. It is rather surprising in view of the occurrence of thick seams at shallow depths, This lack of interest in surface mining probably stemmed from cheap labour costs. With the recent increases in labour costs it seems almost certain that more attention will be given to the strip mining. Data on productivity are scanty. Productivity can be recorded as high as 4 ton saleable output per man per day assuming 225 working shifts/year. Some 73 thousand workers are engaged in coal mines. Operating costs in 1974 currency were Rd 2,2 per ton at pithead giving the lowest costs in the world mining /1 Rd = approx. 1,15 US doll. 1974/. The development of an underground mine is said to be of the order of R 15-18 per ton of annual output in 1974 currency.

35. South African coal mining has grown in step with power requirements and steel production. Coal is there the predominant source of energy, providing not less than 75% of country's gross energy needs.

South Africa - hard coal production and exports /mtons/

	1970	1974	1975	1976	1977	1978	1979[1]	1980[1]
1.production	54,6	64,6	70,5	74,6	85,4	90,3	103,4	105
2.exports	1,5	2,3	2,7	6,0	12,7	15,4	23,3	25
3.difference for internal use and stock	43,1	62,3	67,8	68,6	72,7	74,9	80,1	75

[1/] provisional figures

Source: World Coal - various issues.

As a main sector in internal coal usage remains power sector. Substantial quantities are consumed by steel industry, gasworks and by Sasol I coal liquefaction plant as tabulated below:

Rep. of South Africa - internal coal use /mtons/:

consuming sector	1977	1978
power plants	39,9	40,2
coke plants	9,1	8,4
Sasol I	5,1	4,9
gas works	2,2	2,1
others	15,9	14,9
Total internal consumption	72,5	70,5

Source: Coal International Vol. 1 No. 6, October 1979.

Steel industry is expanding as indicated below /Ktons/:

	1970	1974	1975	1976	1977	1978
pig iron	3947	4627	5197	5776	6094	5850
steel	4757	5833	6580	7159	7378	7800

36. South Africa's export markets are of fresh origin. They are concentrated mainly /1978/ in Western Europe. Minor quantities are shipped to Japan, USA and South Asian countries as shown below:

to Western Europe	10,7 mt /of which France 6,8 mt/
to Japan	2,5 mt
to USA	1,0 mt
to other destinations	1,2 mt
t o t a l	15,4 mt

Nearly all exported tonnage is themal coal for power plants with some admixture of anthracite. Its competitivity on world market is based on low sulfur content, price elasticity and well functioning port loading capacity, through Richards Bay new facilities adequate to solve growing export tasks. The quantities of metallurgical coal exported which could be used as additive in blends with premium quality coal are limited to not over 1 mton/year with no prospects for enlargement.

South Africa's steel industry itself is no more self sufficient in metallurgical coal and has arranged imports of US high grade coking

coal for blending with lower grade domestic coals.

37. Future coal output targets are not yet officialy formulated. Assuming a growth rate of 7%/year this target could be as high as 200 mtons/year of saleable output by 1990, allowing:

- internal use of 140-150 mt/yr /by 60-65 mtons more over the present figure mainly for powerplants and gasification/
- exports of 40-50 mt/yr.

Production and export targets could be exceeded under a sufficiently strong inducement /oil crisis, coal as an answer to new energy situation/. Irrespective of how export potential will be established - its role as a metallurgical coal supplier will remain very modest.

J A P A N

COAL DEPOSITS

38. Japan's coal resources and reserves according to X WEC /1977/ are:

geological resources 10^6 tce		technicaly and economically recoverable reserves 10^6 tce	
hard coal	brown coal	hard coal	brown coal
8.583	58	1.000	6

Source: see para. 1.

Reserves relate to deposits of 0,7 m and more thick, to a depth of 1000 m.

Three productive coal fields are: Hokkaido /61% of present coal output/, Kynshu /36%/ and Honshu /3%/.

Nearly half of recoverable reserves is reportedly of metallurgical quality. This means 0,4 billion tons as domestic reserve of this type of coal.

MINING CAPACITY

39. The mining and geological conditions are complex. All coal is mined underground. Number of workers engaged in coal mines amounts to about 36 thousand. Data on productivity are scanty. Assuming 225 working days/year the overall productivity can be of the order of 2,8 tons per man per day in line with Western European coal mining. Hard coal production is gradually decreasing, probably because of the rising costs:

Japan - hard coal production /mtons/:

	1970	1974	1975	1976	1977	1978	1979[1]	1980[1]
hard coal	39,6	20,3	18,5	17,7	18,2	18,0	18	18
of which: metallurgical quality[1]	15	10	9	9	9	9	9	9

[1] provisional figures

Source: World Coal- various issues.

According to announced plans of the Coal Mining Industry Council - the decline in domestic production should be halted by opening new mines and reopening old ones to ensure a long term supply of 20 mt/ year from domestic sources. It would mean an inflow of 10 mtons/yr of domestic coal in metallurgical quality.

COAL IMPORTS AND USE

40. Metallurgical coal is of great importance for Japan's economy in view of the big capacity of its expanding and competitive steel industry.

Thermal coal occupies until now very limited position in country's energy balance. Its consumption lies presently at about 10 mtons/yr of which bulk is domestic origin. Consumption of metallurgical coal varies between 65-70 mtons/yr as average figure in the last decade of which nearly 90% is imported.

As a major coal importer Japan is vulnerable to risks of miner's strikes abroad, unavoidable risks of severe weather or other natural disasters. The severe miner's strike in the USA /1978/ provided impetus for Japan to diversify its sources of supply by developing mining capacities abroad, in which Japanese Companies have an equity interest. Currently such undertakings account for about 1/3 of the Japan's coal imports.

Japan obtains the bulk of its metallurgical coal from Australia, USA and Canada. South Africa, USSR, Poland and China /PRC/ contribute to the balance, i.e. some 10% of Japan's imports.

Japan - salient data on hard coal imports /mtons/:

	1970	1974	1975	1976	1977	1978	1979[1]	1980[1]
hard coal imports	50,2	64,1	62,1	60,8	60,8	55,2	58,5	62
of which from:								
- Australia	18,3	24,9	24,1	23,8	26,4	28,3	27,0	.
- USA	22,9	24,8	23,1	22,0	15,2	8,2	13,5	.
- Canada	4,0	10,0	10,0	10,0	10,8	11,4	10,5	.
- South Africa	-	-	-	1,0	2,5	2,5	2,5	.
- Other	5,0	4,4	4,9	4,0	5,9	4,8	5,0	.

1/ provisional figures.

Source: International Coal Trade; various issues.

41. Japan has accumulated great experience in the metallurgical coal and coke use. Coke rate is in Japan lowest worldwide, oscillating between 450 and 430 kg/ton of pig iron in the period under review. Blast furnace productivity of more than 2 ton of hot metal per cubic meter and day has been achieved as a national average figure. Coking capacity is modern and sufficient to meet in excess all internal coke demand. It amounts reportedly to about 55 mtons/yr of which some 50 mt/yr in integrated steel works and 5 mtons/yr as independent coke plants.

Japan - salient data on coking charge, pig iron and steel /mt/:

	1970	1974	1975	1976	1977	1978	1979[1]	1980[1]
coal carbonized[2]	60,1	66,5	65,1	64,4	64,4	63,0	65,8	65,8
coke produced	42,9	48,6	46,5	46,0	46,0	45,0	47,0	47,0
pig iron	68,0	90,4	86,9	86,6	85,9	78,1	83	85
steel	93,3	117,1	102,3	107,4	102,4	102,1	107	114

1/ provisional figures
2/ Rapporteur's estimate /coal rate = 1,4/

Source: Annual Bulletin of Steel Statistics.

42. Despite all uncertainties and risks associated with forecasts on the future steel production and demand some simple scenario for the coming decade might be regarded as realistic. If a growth rate of 2%/year is assumed - following targets for Japan's steel industry can be set:

- by 1985 - steel output 125 mt; pig iron about 93 mt
- by 1990 - steel output 139 mt; pig iron about 104 mt.

An increase of the primary iron output by 20 mt/yr through next decade could result in increased metallurgical coal demand by approximately 15 mtons/year over the present level. This means that an import of metallurgical coal could rise to 75-80 mtons/year /thermal coal not included/.

43. In order to handle this increase in coal imports the Japanese Ministry of International Trade and Industry /MITI/ is studying the possibility of "coal centers". The concept is based on the massive scale of the future coal developments abroad ranging from mining, over transportation to stockage and use. Coal centers will reportedly accomodate the coal inflow, store and mix the coal according to user's specification and deliver the right amount at the right time. China /PRC/ could become a significant coal supplier provided extensive financial Japan's participation.

I N D I A

COAL DEPOSITS

44. India's coal resources and reserves according to X WEC /1977/ are:

geological resources 10^6 tce		technically and economically recoverable reserves 10^6 tce	
hard coal	brown coal	hard coal	brown coal
55.575	1.224	33.345	355

Source: see para. 1.

Above quantities relate to deposits over 0,7 m thick to a 900 m depth.

Coal deposits are unevenly distributed in different regions of the country. Five major coalfields are: Iharia /Bihar/, North and South Karampura /Bihar/, Raniganj /West Bengal/, Singrauli /Madhya Pradesh/.

Indian coals were formed - in contrast to US and European coals - under more turbulent conditions /Gondwana/. Organic and mineral components are highly dispersed, hence the washability is poor and the ash content even after beneficiation - high /18-20%/. Sulfur content is low. Recoverability of clean metallurgical coal is some 60% of the feed.

45. Only source of metallurgical coal is Iharia coalfield. According to IX WEC /Detroit 1974/ it contains 4,5 billion ton reserves of metallurgical quality.

Mining and geological conditions are complex and generally difficult. About 75% of the present output is deep minded, the balance /25%/ - surface mined.

MINING CAPACITY

46. India's coal industry is nationalized. Coal India Limited /CIL/ has been established. At present there are 360 underground and 95 surface mines. Hard coal output oscillates now on the level of 100 mt/year being hampered mainly by shortage of electric power, explosives and transport capacity /railway/ to carry the coal from the mines.

About 600 thousand men are employed. Overall productivity is of the order of 0,7 ton per man per day. Wages constitute about 64% of mining costs. Internal coal prices /50-100 rupee/t./ are controlled and partly subsidized /1 rupee = 0,25 US doll./.

India - hard coal output

1970	1974	1975	1976	1977	1978	1979[1]	1980[1]
73,7	83,3	95,9	101,9	101,3	101,3	102	102

[1] provisional figures.

Source: World Coal - various issues.

Above figures relate to "run of mine" coal with inherent high ash content /27-30%/ of which some 15 mtons/year are beneficiated yielding about 10 mtons/yr of metallurgical coal for internal demand, i.e. metallurgical and soft coke.

47. Further expansion of coal output is determined by internal demand. Demand orientated programs has not been very successful until now. The plan goal for fiscal year 1979/80 /ending in March 1980/ was set at 118 mtons, hence shortfall accounts for 16 mtons. Some positive factors are in sight such as increased wages in coal mining and installation of some "captive" power plants at collieries to alleviate electric power shortfalls, but the insufficient transport capacity will need time and heavy investments to overcome logistic problems.

Assuming the annual growth rate of 7% through 1985 and 4% thereafter following target could be achieved:

1985 - 140 mtons
1990 - 165 mtons.

No substantial gains in metallurgical coal output are expected over the present figures. All gains will be associated primarily with thermal coal for power plants and domestic sector. Some demand projections to reach a level of 213 mtons by 1987/88 seem unattainable.

COAL USE AND EXPORT AVAILABILITY

48. Data on coal use relate to run of mine coal and therefore are not quite comparable with those cited in developed countries. Provisional figures for fiscal year 1977/78 are:

power plants	29,8 mtons
steel industry	22,8 mtons
railways	13,0 mtons
soft coke	4,7 mtons
other purposes	21,7 mtons
t o t a l	92,0 mtons

Source: International Coal Trade - various issues.

Hard coal accounts for about 60% of electric power generated.

49. India's steel industry is relatively modern. It is till now nearly selfsufficient in metallurgical coal from domestic sources.

India - pig iron and steel output /Ktons/

	1970	1974	1975	1976	1977	1978	1979[1]	1980[1]
pig iron	6901	7223	8353	9776	9785	9269	8700	10.000
steel	6211	7068	7989	9545	10009	10099	9500	10.000

1/ provisional figures

Source: Stahl und Eisen

India's steel industry has initiated imports of premium grade metallurgical coal to ameliorate coke quality and to rationalize its use.

Imports of about 1 mton/year metallurgical coal are to be expected by 1985 and probably more thereafter.

From other side Coal India Limited /CIL/ has initiated thermal coal exports of the similar order of magnitude /about 1 mton annually/ as a means to earn foreign currency and solve stockpiling problems at collieries in the periods of slackening internal demand.

Summing up, India has perspective to remain nearly selfsufficient as regards coal supplies to its steel industry and other sectors in the coming decade.

K O R E A /Rep. of/

50. South Korean coal resources and reserves are recorded as follows:

geological resources 10^6 tce		Technically and economically recoverable reserves 10^6 tce	
hard coal	brown coal	hard coal	brown coal
921	...	368	...

Source: see para. 1.

Above cited figures seem to be conservative and can be expanded. No secured data on coal characteristic are available. Low volatile - bituminous coals and anthracite are prevailing. Coal output in terms of "run of mine" coal is tabulated below /mtons/:

1970	1974	1975	1976	1977	1978	1979[1]	1980
10,2	12,4	15,0	16,0	16,4	17,2	18	18

[1]/provisional figure. Source: World coal - various issues.

An undefined part of domestic coal is used as blending component for coke making. The continuation of the present production targets thorugh 1990's is probably assured.

51. South Korean steel industry is expanding. Below output:

Ktons	1970	1974	1975	1976	1977	1978	1979[1]	1980[1]
pig iron	35	1022	1194	2012	2426	2741	5050	5000
steel	481	1935	2558	3511	4245	4969	7600	7600

[1]/provisional figures. Source: Stahl und Eisen.

About 2 mtons of metallurgical premium grade coal is annually imported in recent years, mainly from USA. Imported coal supplies are expected to rise to 3 mtons by 1980 and to about 5 mtons by 1985 in line with growing country's steel capacity /Pohang Complex/.

T U R K E Y

52. Coal rescurces and reserves are:

geological resources 10^6 tce		technically and economically recoverable reserves 10^6 tce	
hard coal	brown coal	hard coal	brown coal
1291	1977	134	659

Source: see para. 1.

Reserves consist mainly of good quality metallurgical coal.
Hard coal deposits are known as Zonguldak Coal Field at the Black Sea coast. It is expected that workable reserves could be increased by further exploratory work but at greater depth /to 1000 m/ and partly off shore.

553. Five stately owned underground maines and associated washeries perform hard coal output. About 40 thousand workers are employed. Below output of saleable coal /mtons/:

1970	1974	1975	1976	1977	1978	1979[1]	1980[1]
4,6	5,0	4,8	4,6	4,4	4,3	4	4

Mining conditions are difficult, productivity low, labour costs high, contributing to 80% of total pithead costs.
Coal deposits are heavily faulted and folded.
Recoverability of saleable coal is some 60% due to poor washability. Ash content in saleable coal is reported by 12,8%. Prospects for enlargement of the mining capacity are modest. Targets of 5-6 mtons of saleable production annually are officially announced in the 1980's under most favourable conditions. A lower limit seems to be more realistic.

54. Turkey's steel capacity is moderately expanding in recent years. Below production data /Ktons/:

	1970	1974	1975	1976	1977	1978	1979[1]	1980[1]
pig iron	1156	1317	1337	1214	1361	1000	1000	1000
steel	1312	1464	1465	1405	1865	2172	2400	2400

1/ provisional figures.

Source: Stahl und Eisen.

Some undefined quantity of metallurgical coal and coke must be imported now /mainly from USSR/ to outbalance domestic supplies and growing internal needs.

Assuming that steel production will double through 1990 Turkey's steel industry will need metallurgical coal imports of about 2 mt annually.

L A T I N A M E R I C A

COAL DEPOSITS

55. According to X WEC /1977/ following Latin America's coal resources and reserves are recorded:

Country	geological resources 10^6 tce		technically and economically recoverable reserves 10^6 tce	
	hard coal	brown coal	hard coal	brown coal
Argentina	-	384	-	260
Brazil	4040	6042	2510	5588
Chile	2438	2147	36	126
Colombia	7833	666	397	46
Mexico	8448	-	875	-
Peru	1673	50	106	-
Venezuela	1939	-	978	-
T o t a l	26371	9289	4902	6050

Source: see para. 1

Data on mineable reserves are not fully comparable due to unsatisfactory prospecting. Some enlargement potential is to be expected particularly in Brazil, Colombia and Venezuela. Roughly 1/4 of the mineable reserves i.e. 1,2 billion mtons can be assessed as of metallurgical quality.

Argentina. Mineable reserves are situated around Rio Turbio in the Southern country's province. The coal is of inferior rank, highly mineralized and of poor washability, without perspective on metallurgical use.

Brazil. Mineable reserves occur in Provinces Santa Catarina, Rio Grande do Sul and Parana. Run of mine coal is of high ash content, hence greatly reduced when upgraded to a saleable quality. Selected coals mainly from Santa Catarina can be admixed as blending components for coke making in a mixture with imported premium grade metallurgical coal. There are some encouraging signs that substan-

tial reserves may lie in Amazona States near Peruvian border.

Colombia. Mineable reserves are there most promising from the angle of suitability for coke making. They are located mainly in the Province Guajira. Prospects for development of new deposits are favourable both for internal demand and for exports.

Chile. Deposits are small, coal quality low, without chance to play a role as metallurgical source.

Mexico. Mineable reserves are located mainly in Coahuila District occuring in two basins: Sabinas and Escondido. Coal from the former basin is suitable only as blending component for coke making, while that of the latter is of low rank thermal coal.

Peru. Mineable reserves occur in the Onyon area. Coal here extracted is low volatile, partly anthracitic, highly mineralized and hardly suited as blending component.

Venezuela. Most known and prospective are Zulia deposits about 80 km from port Maracaibo. Coal characteristics recorded from boreholes suggest the occurrence of metallurgical quality coal of high volatile rank and low sulfur content. Further prospecting is necessary.

MINING CAPACITY AND OUTPUT

56. Mining conditions are in most cases complex and difficult. Poor washability results in low recoverability of saleable output. /about 60%/. Insufficient infrastructure poses some logistic and transport problems.

Present mining capacity is modest and equals the present saleable output of about 10 mtons/year /1977/ which means nearly the same figure as in preceeding years of the past decade:

Latin America - saleable hard coal output /mtons/

Country	1970	1977	of which: metallurgical[1]	thermal
Argentina	0,5	0,6	0,1	0,5
Brazil	3,0	2,7	1,0	1,7
Chile	1,2	1,1	0,2	0,9
Colombia	3,5	3,6	0,4	3,2
Mexico	2,0	2,2	2,0	0,2
Peru	0,1	0,1	-	0,1
Venezuela	0,1	0,1	-	0,1

[1] refers to coal used as blending component
Source: ILAFA studies.

57. Steel industry will be a main stimulus in the expansion of coal mining in Latin America, helping to diminish the outlays for imported metallurgical coal. Below brief information on investment intentions and relevant programms.

Argentina. The YCF /Yacimientos Carboniferos Fiscales/ intends to double saleable output through 1985. Investigations are made on use of Rio Turbio coal as blending component after low temperature carbonization.

Brazil. Federal Governments program to increase coal output in Santa Catarina includes opening of 6 mines with totalled capacity of 3,0 mt/yr of saleable coal, of which 1,5 mt/yr will be metallurgical /"blending" quality - ash content 18,5%/ and the remainder - thermal coal. Investments are estimated to be some 200 mln dollars.

Chile. The ENECAR /Europesa Nacional de Carbon/ has undertaken a study of the Arauco region on modernizing coal mines and reducing heavy manual work.

Colombia. The present furthest advanced is El Cerrejon Project in La Guajira. Investment requirements are estimated at 1000 mln dollars, including a rail line to adjacent port. The output target

has been set at 15 mt/yr of raw coal by 1990. About 2 mtons of metallurgical coal may be probably exported from El Cerrejon in 1985.

Mexico. The Federal Commission on Electricity is planning to expand coal mining in view of the growing demand for coal in power plants. Coal output will increase probably by 50% during the next years over the present figure.

Peru. SIDERPERU investigates possibility to use domestic low volatile coal as a blend component for a planned coke plant at Chimbote. A feasibility study is conducted on the coal deposit at Albo Chicama in connection with thermal 480 MW powerplant.

VENEZUELA. CORPOZULIA projects to expand mining capacity on Guesare coalfield to achieve a target of about 4 mtons annually in 1990's. By 1985 an output of 1 mt is scheduled of which 0,5 mt as blending coal for the projected coke plant, the remainder being burnt in the adjacent powerplant.

57. A scenario of the possible coal mining capacity in Latin America has been recently prepared by ILAFA as tabulated below:

Country	1977 /facts/ as mined	saleable	1985 /forecast/ as mined	saleable
Argentina	1,2	0,6	2,5	1,3
Brazil	3,0	2,7	9,5	8,5
Chile	1,6	1,1	2,7	1,9
Colombia	4,0	3,6	7,0	6,8
Mexico	5,2	2,2	12,0	8,0
Peru	0,1	0,1	1,0	0,7
Venezuela	0,2	0,1	1,5	1,2
T o t a l	15,3	10,4	36,2	28,4

Source: ILAFA Secretariat /Santiago/, 1979.

All above targets seem unattainable, bearing in mind the lead time needed and costs associated of the upstream and downstream infra-

structure. Assuming a growth rate of 7%/year a target of 20 mtons of saleable coal by 1985 could be assessed as realistic figure. Of the above total some 40% i.e. 8 mtons could be of metallurgical quality at best.

COAL USE AND IMPORTS

58. Latin America expands its steel industry as shown below:

Salient data on pig iron and steel production /Ktons/

	1970	1974	1975	1976	1977	1978	1979[1]	1980[1]
pig iron[x]								
Argentina	815	1068	1043	1288	1385	1819	1950	
Brazil	4205	5989	7265	8432	9738	10313	10550	
Chile	481	516	417	403	431	539	600	
Colombia	229	269	298	286	222	297	275	
Mexico	2261	3208	2962	3528	4329	5136	5200	
Peru	86	303	286	226	241	246	300	
Venezuela	510	545	535	422	497	689	800	
T o t a l	8587	10898	12806	14585	16843	19039	19675	22000
steel								
Argentina	1823	2354	2200	2407	2682	2782	3200	
Brazil	5390	7502	8308	9194	11164	12107	13730	
Chile	592	635	490	482	548	561	650	
Columbia	310	333	391	356	330	391	360	
Mexico	3881	5138	5272	5297	5601	6741	7000	
Peru	94	450	431	346	379	377	450	
Venezuela	927	1058	1100	937	854	860	1200	
T o t a l	13017	17470	18192	19019	21558	23819	26590	29000

[1]/provisional figures
[x]/incl. sponge iron
Source: Stahl und Eisen; Metal Bulletin Monthly No.109, Jan. 1980

59. By 1985 Latin America intends - according to recent national programs - to reach a steelmaking capacity of 60 mtons/year or twice the present capacity.

This ambitious target seems attainable rather as a possible 1990 scenario or so.

If one assumes a growth rate of 10% up to 1985 and 7% since then - metallurgical coal requirements of the region are expected to double by 1985 resp. to treble by 1990 against the present figure resulting in total demand of 18 resp. 26 mtons per year as shown below:

Latin America - scenario on metallurgical coal use /mtons/

	1980[1] facts	1985[2] prospects	1990[2]
steel output	29,0	46,0	65,0
primary iron	22,0	36,0	50,0
of which:			
pig iron coke smelted	15,0	27,0	38,0
pig iron charcoal smelted	3,0	3,0	3,0
sponge iron	3,0	6,0	9,0
coal carbonized	10,0	18,0	26,0
of which:			
indigenous	3,5	6,0	9,0
imported	6,5	12,0	18,0

1/ preliminary figures
2/ Rapporteur's estimate

60. Latin America's steel industry has relatively modern coking capacity totalling about 12 mtons of coke/year. Majority of the existing 30 coke oven batteries consist of by-product ovens between 30 and 37 cubic meters by volume. Below short illustration relating to 1978:

Latin America - coking capacity

Country	Batteries	Ovens	mt/year Capacity	Company
Argentina	4	165	1,5	SOMISA
Brazil	12	581	5,5	CSN, COSIPA, USIMINAS
Chile	1	70	0,4	Compania Acero del Pacific
Colombia	1	57	0,3	Aceras Paz del Rio
Mexico	12	519	4,3	AHAMSA; SICARTSA etc.
T o t a l	30	1392	12,0	

Source: ILAFA, General Secretariat /Santiago/ 1979

Additional capacity will be needed, particularly in Argentina, Brazil and Mexico if announced steel targets have to materialize.

61. Main suppliers of metallurgical coal into the region are: USA, Poland and Canada while as the main consumers remain Brazil, Argentina and Mexico. Below 1979 approximate figures /mtons/:

Exporting country		Importing country	
USA	4,0	Argentina	1,0
Poland	1,5	Brazil	3,5
Canada	0,5	Mexico	0,8
		Other	0,7
T o t a l	6,0	T o t a l	6,0

Source: Coal International, various issues.

Doubling of coal imports by 1985 resp. its trebling by 1990 seems to pose no unattainable problems from existing sources of supply provided that long term contracts will be made in a proper time. In view of poor washability and structural inhomogeneity of indigenous coals only "premium grade" imported coals should be preferred. Rising freight rates will act towards imports from neighbouring North American suppliers.

AFRICA AND ARAB WORLD

COAL DEPOSITS AND MINING

62. The Afro-Arab developing countries are well endowed with high grade iron ore, natural gas and oil. By contrast - recoverable coal reserves are small or economically submarginal under present conditions, bearing in mind complex geological conditions, rather low coal quality, long distance to fuel consuming centers and insufficient logistic infrastructure. Below most recent data on coal resources and reserves:

Country	geological resources 10^6 tce		technically and economically recoverable reserves 10^6 tce	
	hard coal	brown coal	hard coal	brown coal
Botswana /Rep.of/	100.000	...	3.500	...
Mozambique	400	...	80	...
Nigeria	...	180	...	90
Swaziland	5.000	...	1.820	...
Zambia	226	...	5	...
Zimbabwe	7.130	...	755	...
Other	2.590	...	970	...
T o t a l	113.346	180	7.130	90

Source: see para. 1

Botswana. Shell Coal Botswana, a subsidiary of the Royal/Dutch Shell group is on intensive prospecting for coal reserves. No secured data on coal quality are available. The present coal output from the Morupule deposit is about 0,6 mt /1978/.

Mozambique. There is reportedly some enlarging potential of low volatile coal and anthracite reserves. Present coal output at the Moatize deposit is about 0,6 mt /1978/. Investments are needed to solve transport problem from coal deposit to the adjacent Beira-port /480 km/.

Nigeria. Main reserves are situated at Enugu. The Nigerian Coal Corp. is engaged in building up mining capacity with aid of Polish

team. Present coal output is at 0,7 mt figure.

Swaziland. Reserves are located in Lemombo district. At present one drift mine at Mbabane is operated by Anglo-American Corporation. Current output of 0,3 mt is reported. Prospects are considered to be good if the transport possibilities could be developed via Richards Bay or Lourenco Marques port facilities.

Zambia. Workable reserves lie in the southern part of the country. Output of 0,4 mt comes from Maamba mine.

Zimbabwe. It is only developing African country with a relatively modern coal mining operated by Anglo-American Corporation. Current output of 3 mt is reported, half of which open cast workings at the Wankie coal deposit.

Summing up - the prospects for indigenous metallurgical coal are encouraging. Present coal output in the whole area - about 5 mt/year - will be on upward trend but mainly for small local industry and domestic purposes.

63. Steel production in the area under review /South Africa not included/ is only about 0,8 mtons/year high. Algeria and Arab Republik of Egypt /ARE/ are here the only countries possessing integrated steel plants.

Algeria. It is one of the most dynamic and fast developing countries with an outstanding rate of irdustrial growth. The expansion of El Hadyar Works at Annaba is now under way. In the initial stage the route: pellets - sponge iron and electric smelting seems to be preferable in view of rich natural gas resources. Further evolution of steel capacity could involve large metallurgical units based on BF/BOF route. Imports of metallurgical coal could be secured on long term contracts if paid by equivalent supplies of

natural gas or oil. Some examples of such barter contracts are well known.

Arab Republic of Egypt. The Helwan Steel Complex will probably further expand using the route via pellets, sponge iron and electric smelting. No secured data on the steel scenario in this country are available.

The entire subject of steel industry development in Africa and Arab World should be further analyzed in its full complexity:

- demand projections,
- available resources indigenous and imported,
- process routes,
- capital and operating costs as well as revenues,
- mode of financing,
- training of man power and management.

The reviewed area possesses favourable preconditions for the establishment of substantial sponge iron capacity based on the use of high grade pellets and natural gas resources, as a first step on the way to indigenous steel production. It is likely to be well into 1990's before significant steel capacity can occur. For the bulk of the period under consideration Africa and Arab World can be considered as coal poor.

Salient data on pigiron and steel production /Ktons/ below:

	1970	1976	1977	1978	1979
pig iron					
1. Algeria	409	413	389	400	400
2. Egypt	454	569	550	600	600
3. Rhodesia	250	310	300	300	300
4. Tunisia	125	112	137	150	150
Total /1-4/	1238	1404	1376	1450	1450
steel					
1. Algeria	31	356	410	580	600
2. Egypt	264	600	600	1115	1150
3. Rhodesia	374	350	350	350	350
4. Tunisia	105	135	121	195	200
Total /1-4/	774	1441	1481	2240	2300

Source: Stahl und Eisen

CMEA COUNTRIES

/The term "CMEA" refers to member countries associated in the Council of Mutual Economic Assistance: Bulgaria, Czechoslovakia, German Democratic Republic, Hungary, Poland, Romania and USSR/.

COAL DEPOSITS

64. Recent data on coal resources and reserves according to X WEC /1977/ are:

Country	Geological resources 10^6 tce		technically and economically recoverable reserves 10^6 tce	
	hard coal	brown coal	hard coal	brown coal
Bulgaria	51	2.599	24	2.179
Czechoslovakia	11.573	5.914	2.493	2.322
German Dem.Rep.	200	9.200	100	7.500
Hungary	714	2.839	275	725
Poland	121.000	4.500	20.000	1.000
USSR	3.000.000	867.000	82.900	27.000
T o t a l	3.133.538	892.052	85.792	40.726

Source: see para. 1

Above reserves relate to deposits of more than 0,7 m thick to a depth of 900 m. A share of 25% of metallurgical quality coal according to IX WEC /1974/ can be assessed.

USSR. Principal hard coal deposits are Donetsk and the Pechora basins in the European Region, together with Kuznetsk and Karaganda basins in Eastern Regions.

Poland. The major and most profitable hard coal deposits are located in Upper Silesian Basin. The Rybnik district in the south-western edge of this Basin yields bulk of premium grade metallurgical coal.

Czechoslovakia. Hard coal deposits lie in Ostrava-Karvina district, which is continuation of the Upper Silesian Basin in its south-western part.

Other Countries. Reserves of hard coal are insignificant, coal quality and washability poor. GDR has ceased its hard coal output in 1977 at all.

MINING CAPACITY

65. Mining capacity expanded in the whole area under rewiev during the last decade at the rate of 2,2% annually, from 612 mtons /1970/ to 740 mtons /1979/ of saleable hard coal output. About 65% of the USSR production comes from underground mines. In Poland, Czechoslovakia and remaining countries all hard coal is underground mined. All growth in mining capacity is realized in USSR and Poland. Roughly 1/4 of the saleable output is metallurgical quality coal.

CMEA Countries - Hard coal output /mtons/

	1970	1974	1975	1976	1977	1978	1979[1]	1980[1]
USSR	432,7	473,4	485,0	494,3	499,7	504,8	495,9	505
Poland	140,1	162,0	171,6	179,3	186,1	192,6	201,0	207
Czechoslovakia	28,0	27,6	27,8	27,8	28,0	28,3	28,0	28
Other	11,2	11,0	10,6	10,6	10,2	10,0	10,0	10
T o t a l	612,0	674,0	695,0	712,0	724,0	732,7	734,9	750

1/ provisional figures
Source: Annual Bulletin of Coal Statistics.

66. New developments are realized. In USSR the Neryunga project for metallurgical coal in South Yakutia is well advanced with Japanese financial participation. In Poland further projects are realized in Rybnik district /metallurgical coal/ and on the new coalfield in Lublin district /thermal coal/.
Assuming the growth rate of 2% annually following production target for hard coal seems realistic:

1985 - 820 mtons

1990 - 900 mtons.

Rail transportation on long distance poses problems of technical and economical nature, which limit the accessibility of some deposits for internal and external market.

COAL USE AND EXPORT AVAILABILITY

67. Bulk of hard coal in CMEA region is internal consumed mainly for power generation, other industrial use and domestic purposes. About 170 mt/year, i.e. 24% of actual internal consumption totalled at 700 mt is carbonized yielding about 122 mt of coke /1979/ CMEA region is selfsufficient as regards to metallurgical coal having some excess for the export market outside.
Intercontinentally traded quantities of CMEA metallurgical coal are relatively modest accounting to about 15 mt/year /1978/ of which from Poland - 9 mtons and from USSR - 6 mtons. Only Romania is a net importing country for its expanding steel industry with import quota of about 2 mtons of metallurgical coal from outside CMEA region.

68. Steel capacity expanded in CMEA region at a rate of 3,6%/ year during the last decade. Coking capacity has also expanded, but at lower rate of growth as shown below:

CMEA Countries - pig iron, steel and coke output /mt/

	1970	1974	1978	1979[1]	1980[1]
Steel production	155,7	185,0	211,1	210,1	215
of which:					
- USSR	115,9	136,2	151,4	149,5	.
- Poland	11,7	14,5	19,2	19,2	.
- Czechoslovakia	11,5	13,6	15,3	15,1	.
- Other	16,6	20,7	25,2	26,3	.

	1970	1974	1978	1979[1]	1980[1]
pig iron production	109,6	128,7	145,9	144,6	145
of which:					
- USSR	85,9	99,9	110,7	109,0	.
- Poland	7,8	7,8	11,2	11,1	.
- Czechoslovakia	7,5	8,9	9,9	10,0	.
- Other	9,2	12,1	14,1	14,5	.
coke production	102,0	115,0	122,0	123	125
of which:					
- USSR	75,0	82,7	85,7	.	.
- Poland	14,0	16,0	19,4	.	.
- Czechoslovakia	10,5	10,9	11,0	.	.
- Other	3,5	5,4	5,9	.	.

1/ provisional figures

Source: Annual Bulletin of Steel Statistics.

69. Assuming the growth rate of 2%/year resp. 3%/year as likely scenarios for steel output in the 1980's following CMEA targets may be assessed as probable /mtons/:

	2% growth	3% growth
steel		
1985	235	249
1990	260	289
pig iron		
1985	158	168
1990	175	195

Growing internal needs will be a limiting factor in offering the surpluses of metallurgical coal for external markets over the present figure of about 15 mtons annually.

ASIAN CPE COUNTRIES

/The term refers to Centrally Planned Economy Countries in Asia: People's Republic of China, Democratic People's Republic of Korea and Vietnam /.

COAL DEPOSITS

70. Recent data on coal resources and reserves according to X WEC /1977/ are:

Country	Geological resources 10^6 tce		Technically and economically recoverable reserves 10^6 tce	
	hard coal	brown coal	hard coal	brown coal
China /PRc/	1.424.000	12.368	98.883	n.a.
Korea /DR/	3.000	...	500	1.180
Vietnam	1.000	...	200	...
t o t a l	1.428.000	...	99.586	...

Source: see para. 1

Secured data on the type of reserves are not available. A share of about 15% of coal of metallurgical quality is likely.

China /PRC/. Principal hard coal deposits lie in Northern China /Province Heilungkiang, Liaoning, Anhwei, Shansi/. Nearly 1/3 of mineable reserves is reportedly suitable for coke making. Secured data on coal quality and washability are lacking.

Korea /DR/. Hard coal deposits concentrated in South Phyongyan Province.

Vietnam. Main anthracite deposits near Haiphong.

MINING CAPACITY

71. Mining capacity in the whole area under review can be assessed as high as 550 mtons/year of which roughly one half comes from relatively big underground and surface mines - the balance being small, local ones. Operating costs are likely to be low - probably similar to those of South African coal.

Data on coal output must be viewed with some caution since no official data are published. Below data relate to "run of mine" output.

Asian CPE countries - hard coal output /mtons/

	1970	1974	1977	1978	1979
China /PRC/	360,0	460,0	550,0	618,0	663,2
Korea /DR/	24,0	40,0	34,5	35,0	35,0
Vietnam	3,0	3,0	6,1	6,2	6,1
T o t a l	387,0	473,0	590,0	659,2	704,3

Source: World Coal

Assuming growth rate of 3%/year a target of 680 mtons /1985/ resp. 805 mtons /1990/ could be expected under extensive foreign participation.

STEEL CAPACITY AND COAL EXPORT AVAILABILITY

72. Asian CPE countries are selfsufficient in covering the internal demand including steel industry. Steel capacity in this region probably doubled during the last decade:

Asian CPE Countries - pig iron and steel output[1] /mtons/:

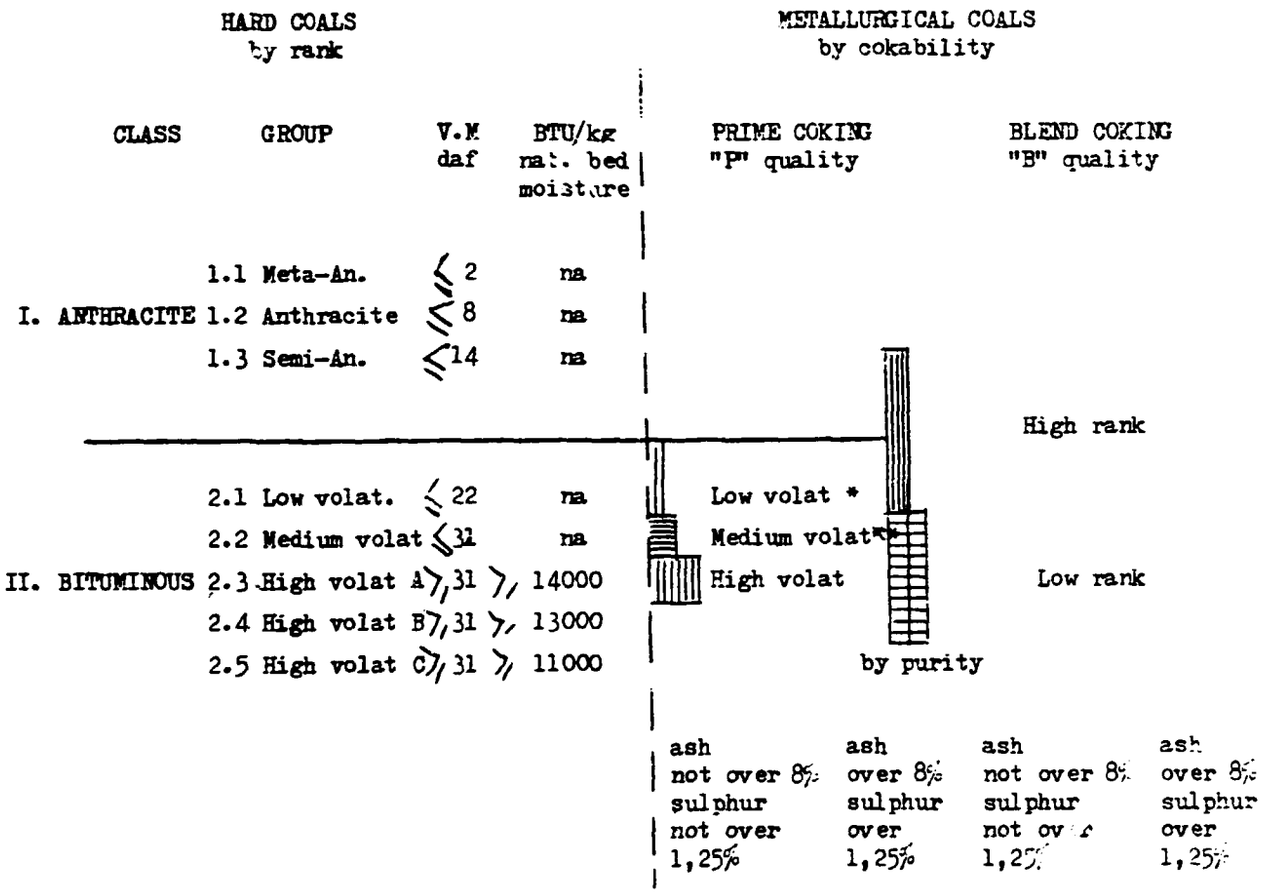
	1970	1974	1976	1977	1978	1979
pig iron:						
- China /PR/	16,2	22,0	20,0	25,5	34,8	36,5
- Korea /DR/	2,4	3,0	3,0	3,1	3,2	3,2
- Vietnam	-	-	-	-	-	-
T o t a l	18,6	25,0	23,0	28,6	38,0	39,7
steel:						
- China /PR/	15,7	24,0	20,5	23,7	31,8	34,4
- Korea /DR/	2,2	2,7	3,0	3,1	3,2	3,2
- Vietnam	-	-	-	-	-	-
T o t a l	17,7	26,7	23,5	26,8	35,0	37,6

1/ approximate figures

Source: Stahl und Eisen

73. It is hardly to assess the possibility, capability or willingness of China's participation as a supplier of metallurgical coal in the years to come.
All what can be probably done is the availability to secure the own growing steel capacity. China's trade in coal is limited to about 1 mton/year to Japan /1979/ according to bilateral trade agreement signed in 1978.

POSITION OF METALLURGICAL COALS WITHIN HARD COAL



* Notice: two varieties recognizable on international market

(a) "hard" coking quality; high mix potential; usually up to 30 percent in blend

(b) "soft" coking quality; moderate mix potential; usually up to 70 percent in blend

Tentative characteristic of the "hard" coking quality:

- narrow spread of coalification (reflectance)
- low intertinite content i.e. high petrological homogeneity
- high maximal dilatation D; usually above 100%
- high maximum fluidity (by the Grieseler Test) F max
- broad plastic transient range (Tso-Tis); usually above 80 centigrades
- high free swelling index (FSI); usually above 7