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Economic Intelligence Report

COKING COAL AND COKE IN THE SOVIET BLOC 1960 AND PROSPECTS FOR 1965

CIA/RR ER 61-54

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CENTRAL INTELLIGENCE AGENCY

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FOREWORD

The purpose of this report is to assess the resources of coking coal in the Soviet Bloc (USSR and European Satellites) and to determine the supply and demand for coking coal and coke in individual countries during recent years and in 1965. Only a very small part of the tremendous coal reserves in the USSR and of the lesser but significant reserves in the European Satellites consists of prime coking coals, and problems associated with the supply of such coals are chronic. As a consequence, the Soviet Bloc, in order to meet its requirements for oven coke, is dependent to a considerable degree on coals that lack the desired properties for coking.

The scope of this report is restricted to coals that are used in the manufacture of oven coke, which is essential for metallurgical purposes, primarily in the smelting of pig iron, and does not cover the use of lower quality coals suitable for the manufacture of coke by medium-temperature and low-temperature carbonization. The report does not deal with the important and broad range of primary and derivative chemicals obtained as byproducts from high-temperature carbonization (900° to 1,000° C).

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COKING COAL AND COKE IN THE SOVIET BLOC*
1960 AND PROSPECTS FOR 1965

Summary and Conclusions

In 1960 the Soviet Bloc produced 77.4 million metric tons** of oven (or high-temperature) coke,*** or 27.7 percent of the world output of about 279 million tons.† Among all nations the USSR ranked first (as it has since 1958) with 56.2 million tons,†† Poland was seventh with 11.0 million tons, and Czechoslovakia was ninth with 7.9 million tons. East Germany, Hungary, and Rumania each produced less than 1 million tons, and neither Albania nor Bulgaria produced any coke for metallurgical purposes.

In spite of the present high level of production, Bloc planners anticipate that providing for adequate supplies of coke will remain a problem throughout the remainder of the Seven Year Plan (1959-65). Consequently, the major emphasis in the expansion of the coal industry is placed on increasing the output of coking coal. In the USSR, production of coking coal is to increase by 59 to 65 percent during the Seven Year Plan, whereas the total production of coal is to increase by only 21 to 23 percent. Production of premium-quality coking coal in Czechoslovakia is to be 56 percent more in 1965 than it was in 1958, and production of gas-coking coal is to increase substantially in the same time period, whereas the total production of bituminous coal in Czechoslovakia is to increase by only 31 percent. Poland also is attempting to increase production of premium-quality coking coal by 150 percent during 1959-65, although the plan calls for an increase of only 20 percent for the total output of bituminous coal. In the other Satellites, production of coking coal is severely handicapped by inadequate reserves, and none possesses a satisfactory base for a coke industry.

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* The estimates and conclusions in this report represent the best judgment of this Office as of 1 October 1961.

** Tonnages are given in metric tons throughout this report.

*** Oven coke is produced by heating coals to high temperatures in a slot type of oven that is hermetically sealed and designed for recovery of valuable byproducts. The Soviet Bloc apparently does not produce beehive coke, which is obtained by an older and simpler method without the recovery of byproducts.

† The world production figure includes minor quantities of beehive coke.

†† The US, in second place, produced 51.9 million tons in 1960, although capacity exceeded 76 million tons.

According to the plans of the individual countries, production of oven coke (in million tons) in the Soviet Bloc in 1965 will be as follows: USSR, 76.0 to 80.6; Poland, 13.1; Czechoslovakia, 11.3; Rumania, 1.6; East Germany, 1.1; Hungary, 0.8; and Bulgaria, 0.7. It is estimated that the total output of oven coke in these countries, including a small exceeding of the plan in the USSR, will be approximately 110 million tons, representing an increase of 59 percent in comparison with 1958 and 42 percent in comparison with 1960. Of the total production, it is estimated that about 93 million tons will consist of sizes that are classified as metallurgical coke -- that is, larger than 40 millimeters (mm).

Out of an estimated production of about 122 million tons, the USSR will consume about 118 million tons of prepared coking coal at coking plants in 1965.* The USSR will require about 48.3 million tons of metallurgical coke for production of 70 million tons of pig iron. In the event that production of pig iron reaches 72.5 million tons in 1965, which is possible, supplies of coke should still be adequate for all essential needs. Among the European Satellites, only Czechoslovakia is now self-sufficient in coking coal, producing both coking coal and coke for export. Certain types of coal for energy purposes must be imported, however, to permit exports of coking coal. Even Poland, in spite of large reserves of other types of coal, is dependent on imports for a considerable part of its requirements for the best quality of coking coal. Poland, however, has a surplus of inferior quality gas coals that can be used in blends to a limited degree. With the exception of East Germany, which probably will continue to cover part of its requirements by imports from West Germany, all deficits in the supply of coking coal and coke in the other European Satellites probably will be covered through 1965 by surpluses in the USSR, Czechoslovakia, and Poland. Both Czechoslovakia and Poland will be in better position to supply coke than coking coal, although they will not be in a position to supply much foundry coke, which is the best quality of coke.

Czechoslovakia and Poland will each be capable of furnishing the other European Satellites with 2 million to 2.5 million tons of coke, and Czechoslovakia should be capable of exporting nearly 2 million tons of coking coal. Poland will export considerable quantities of gas coals that will be used for coking purposes. In spite of the possibilities for intra-Satellite trade, the Satellites as a whole will have an estimated net import requirement for about 2 million tons of coking coal and 1.5 million tons of metallurgical coke in 1965. The USSR may be able to export as much as 4 million tons of coke and possibly more than 4 million tons of coking coal in 1965. Although a considerable part of these surpluses in

* Production of raw coking coal in 1965 is planned to reach 150 million to 156 million tons, or about one-fourth of the total production of coal.

the USSR probably consists of sizes and qualities unsuitable for metallurgical use, it is probable that the estimated requirements of the Satellites can be covered from production now planned. Should the demand for coking coals in the Satellites exceed the levels estimated, the USSR, if necessary, could increase its production of coking coals considerably above the levels now planned by employing more workers or by increasing the hours worked. In any case, poor quality and high costs will continue to be serious problems in producing coking coal in all the Bloc countries.

With few exceptions, all the coals produced for coking purposes in the Soviet Bloc are high in impurities (rock and sulfur), and cleaning is essential. Because of the high content of impurities, the yield of concentrates after cleaning averages only about 70 percent in the USSR. Yields of less than 50 percent are realized in some of the European Satellites. Donets coals, which provide about 58 percent of the coals used for coking in the USSR, have a sulfur content averaging more than 2 percent, and considerable quantities contain 3 to 3.5 percent. As a result, the sulfur content of the coke made from Donets coals averages about 1.7 percent. More than 1 percent sulfur in coke is considered to be excessive by Western countries because of the undesirable effects on the operation of blast furnaces and the quality of pig iron produced.

To conserve the relatively scarce high-quality coals in the Bloc countries, these coals are blended with less desirable coals, usually gas coals that are not very satisfactory for making coke. Effective blending presents particular problems because of the wide variety of coals available and the difficulty of obtaining complementary coals. Soviet coke plants are forced to mix coals of different types from 10 to 90 mines, in contrast to the practice in the US and Western Europe where blending usually can be limited to coals from 2 or 3 mines. Scarcity of high-quality coking coals forces Bloc countries to use large quantities of weakly caking and noncaking coals, which result in much coke that is too small and weak for satisfactory use as metallurgical coke, particularly in large blast furnaces.

The coke industry of the Soviet Bloc is a high-cost industry because of its dependence on coals produced under difficult conditions and, in some cases, in widely separated regions, necessitating long-distance transport. Currently, more than 90 percent of all coking coal produced in the USSR comes from four basins -- Donets, Kuznetsk, Karaganda, and Pechora. The Urals Region (VIII),* which accounts for about 29 percent of the total production of coke in the USSR in 1960, is almost entirely dependent on coals hauled from the Karaganda Basin, a distance of 1,200 kilometers (km), and from the Kuznetsk Basin, a distance of 1,800 to

* The term region as used in this report refers to the economic regions defined and numbered on the map, inside back cover.

2,300 km. Coking coals are hauled a distance of 2,400 km from the Pechora Basin to Leningrad. Because of the depth, pitch, and thinness of the seams, mining conditions in the Donets basin are as bad as, if not worse than, those found in any major coal basin in the world. Efforts in the USSR to reduce the costs of coal may not be realized, particularly in the important Donets Basin, because of unsatisfactory progress in the construction of larger, more efficient mines as well as in the introduction of better methods of mining. Gains in labor productivity at the underground mines, which account for almost all of the coking coal, have not been significant and will continue at low levels. Costs actually may increase because mining will be conducted at increasingly deeper levels with the consequent necessity of contending with greater rock pressure and more gas and water. In the western parts of the USSR, and in most of the Satellites, coking coal could be imported from the US at less cost per ton than it can be supplied to the cokeries from domestic mines. When comparative quality is considered, imported coal would be even cheaper.

In modern high-temperature coke plants in Western nations, byproducts and the products derived from them have a higher unit value than the coke. In the Soviet Bloc, however, production of coke has been of dominant importance, and the recovery and upgrading of byproducts have received far less consideration than in the West. Steps are being taken, however, particularly in the USSR, to expand the chemical sector of the industry.

I. Introduction

In spite of tremendous reserves of coal in the world, there is, nevertheless, a dearth of certain types of bituminous coals that are required to produce good metallurgical coke. The best type of coking coals, which can be carbonized without blending, is rare in most countries. Such coals have an unusual combination of physical-chemical characteristics and are distinguished by a medium content of volatile matter, strong caking capacity, and the ability to form a strong, porous coke when heated to high temperatures in hermetically sealed ovens. To conserve these particular coals and to broaden the raw material base, it is common practice in most countries to blend them with other types of bituminous coals that ordinarily are strongly caking and contain more or less volatile matter. In some cases, coals are used that are weakly caking or even noncaking, but these inferior coals cannot be used successfully in significant quantities. Coals that complement each other are essential for blending in order to yield coke with the proper strength and size (larger than 40 mm) required for smelting ores, especially iron ores, in blast furnaces. The efficient operation of the furnaces and production of good steel require the use of coke that is low in ash, sulfur, and phosphorus. The distribution of supplies of coking coal in the Free World, in general, is indicated by the fact that millions of tons of these coals each year are shipped thousands of miles from the US to Western Europe, South America, and Japan to be used at coke plants. Even West Germany and, on occasion, Poland, each of which produces more than 100 million tons of bituminous coals annually, have found it expedient to import coking coal from the US because only a minor part of the bituminous coal produced in these countries is suitable for coking.

In the Soviet Bloc, problems connected with the supply of coking coals serve to handicap, in varying degrees, the expansion of production of pig iron. Because their resources are inadequate, each of the Bloc countries except the USSR and Czechoslovakia must import coal to support its coke industry. Although Czechoslovakia is self-sufficient, it imports coal for energy purposes from Poland in order that coking coal can be exported. In the long run the Satellites gradually will become more dependent on the USSR as a source of supply for coking coal. Although the USSR has huge reserves of coal that can be used in blends to produce coke, the country, nevertheless, is compelled to utilize large quantities of coal that are very inferior in quality. Only a minor part of the Soviet coals are sufficiently low in ash and sulfur to meet the high standards that exist at coke plants in the US. Furthermore, quality probably will continue to deteriorate because of the economic necessity of using coals containing more volatile matter in the blends. This trend results from an imbalance in reserves and the necessity for deeper mining to get the better coals. Almost without exception, coking coals are very

expensive to mine in all parts of the USSR and in the Satellites. The USSR also is faced in some cases with high transport costs, especially in supplying the coke plants in the Urals.

The coke industry is large and important in the Soviet Bloc because coke is essential in producing pig iron and ferrous castings and also because there is a growing demand for the valuable byproducts obtained in the coking process. An indication of the importance of coke to the ferrous metals industry of the USSR is the fact that coke represents, on the average, about 50 percent of the costs of producing pig iron and in the Urals alone about 70 percent. 1/* There is heavy dependence on coke gas as a fuel, especially in heating the iron and steel furnaces. Other primary byproducts of coking -- tar, raw benzene, and ammonia water -- are sources of numerous intermediate chemicals that are used to produce many end products, such as liquid fuels, fertilizers, explosives, plastics, solvents, dyes, resins, anticorrosion agents, insecticides, and pharmaceuticals.

II. Supply of and Demand for Coking Coal and Coke in the USSR

A. Resources and Mining Conditions

According to the latest (1957) estimates, the USSR claims to have 8.7 trillion tons of coal reserves (geological). This figure is about five times the size of US reserves of 1.7 trillion tons.** 2/ Of the Soviet reserves, almost 2 trillion tons (22.5 percent) consist of types K, PS, and PZh, which are classified as strongly caking coals, most suitable for coking purposes.*** Significantly a major part of these coking coals -- about 1.5 trillion tons -- is situated in almost inaccessible parts of East Siberia, far from any railroad. The remainder of the reserves is largely concentrated in four basins -- the Donets Basin, located mainly in the eastern part of the Ukrainian SSR (Region III)†; the Pechora Basin in the far northeastern part of Komi ASSR (Region Ib); the Karaganda Basin in the central part of Kazakh SSR (Region Xa); and the Kuznetsk Basin in West Siberia (Region IX). Minor deposits under exploitation exist in the Georgian SSR (Region V); in the Kizel Basin, located in the Urals (Region VIII); at Noril'sk in East Siberia (Region XI); and at Suchan and on Sakhalin Island in the Far East (Region XII). 3/

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** The bases used in estimating the reserves in the US and USSR are believed to be fairly comparable.

*** For a discussion of the classification of Soviet coals, see Appendix A.

† For locations of Soviet coal deposits, see the map, inside back cover.

In spite of the tremendous size of its reserves of coals suitable for coking purposes, the USSR has serious problems in supplying its expanding requirements for these particular coals. The chief difficulties in achieving the required supply are an imbalance in the reserves according to types of coal, problems of quality, and, probably most important, difficult mining conditions. All of these factors have some influence on the supply of coking coals in each of the areas where such coals are mined, and some of the deposits that are mined are not well situated with respect to deposits of iron ore.

The most important producing area is the Donets Basin, which accounts for approximately 58 percent of the total output of coking coal. Coke plants in the Western Regions (I-VII) are almost entirely dependent on this basin, where geological reserves total about 240 billion tons, of which 190 billion tons (so-called "conditional" reserves) are in seams exceeding 0.45 meter in thickness. The estimate of "conditional" reserves, however, includes only 25.2 billion tons that are classified as strongly caking coals. The balance consists mainly of anthracite and gas coals and lesser quantities of lean, long-flame, and subbituminous coals that, with the exception of some of the gas coals, are not satisfactory for making coke. 4/

Although the reserves of Donets coking coals will last far beyond the present century, the USSR is confronted with formidable obstacles in this basin, not only in mining but also in supplying varying types and grades of coals in the proportions required for blending purposes. Mining conditions in the Donets Basin generally are as bad as, if not worse than, in any major coal basin in the world. Almost all of the coal seams are thinner than 1.2 meters, and the average thickness of the seams mined is only about 0.9 meter. 5/ In some cases, mining is conducted where the thickness is less than 0.5 meter. 6/ The thinness as well as the generally considerable dip of the seams contributes to low labor productivity and impedes mechanization. 7/ Besides these disadvantages, excessive quantities of gas and water are encountered as operations descend to deeper levels. About 10 tons of water are pumped to the surface for every ton of coal mined. A large percentage of the mines in the coking coal districts are highly gaseous. 8/ This condition not only represents a serious safety hazard* but also necessitates more expense and attention to ventilation and the use of safe electrical equipment. In the deeper mines, temperatures have increased to the point where it is necessary to supply precooled ventilation.

Current operations in the Donets Basin are at depths where the rock pressure is tremendous, which results in sudden outbursts of rock 50X1

* Official Soviet sources almost never mention mine accidents, but [redacted] that the rate of accidents from various causes is high. 50X1

and coal and creates very difficult problems of roof support,* 9/ and these problems will become even more serious. Of 580 shafts in the Donets Basin in 1956, 227 (39 percent) were operating at depths of more than 300 meters, including 50 shafts at depths of 500 to 800 meters and 1 shaft at more than 800 meters. 10/ Since 1956, even greater depths have been reported. Some coal is now mined at a depth of 1,200 meters, and new shafts are being sunk to 1,400 meters. 11/ Such deep operations are necessary to obtain coal for coking purposes.

As a conservation measure, the USSR follows a general policy of mining each seam that meets minimum standards** as it is encountered in descent from the surface. This policy results in advanced extraction of a seam before an underlying one is removed. Otherwise, caving usually results in fracturing of the overlying strata and prevents recovery of seams at higher levels. Under these conditions, less desirable coals are mined along with better coals, and there is wide variation in types, grades, and quality of the coals produced. About 8 percent of the Donets production is from mines that are working four seams or more. 12/

Significantly, most of the reserves of Donets coking coals are heavily concentrated in a few districts near the west and southwest borders of what is known as the "old" Donets Basin,*** an area of about 23,000 square km including the Stalino-Makeyevka district, a major center of production of coking coal. Mining has been carried on in these districts since the early part of the last century. On the northern border of the basin, seams of coking coal are overlaid by seams of noncoking coals that normally would be mined first. Thus immediate expansion of the base for production of the better types of coking coal in the Donets Basin is limited mostly to development of deeper seams in the old mining districts.

Soviet authorities have become increasingly concerned about the difficulties in producing the more desirable types of coking coal in the Donets Basin and about the more rapid exhaustion of these coals in relation to over-all reserves. Consequently, considerable attention is being

* The mines have been converting from wood props to ferroconcrete and massive steel supports. Losses of supporting material, according to reports, are large and are caused by caving as well as by the difficulties of recovery.

** The minimum thickness varies from 0.6 to 0.7 meter in all coalfields except in the Donets Basin, where apparently it is 0.45 meter. Seams with an ash content exceeding 40 percent usually are not mined.

*** During the postwar period, new coal deposits have been discovered that surround many parts of what were long considered to be the limits of the basin's coal measures. These new deposits, however, contain little coal of the types that are classified as strongly caking.

given to the use of less desirable types of coal in the blends of coal charged at the coke ovens. The proportion of gas coals has been increasing steadily, and minor quantities of lean and long-flame coals also are included in some of the blends.

Donets coals have one very serious disadvantage for use in metallurgy, for nearly all of these coals have a high content of sulfur, averaging more than 2 percent even after cleaning. As a consequence, Donets coke averages about 1.7 percent sulfur, which contributes to lower efficiency at blast furnaces and has a deleterious effect on the quality of pig iron.

With the exception of the Donets Basin, the only other coal basin in the Western Regions with important reserves of coals suitable for coking purposes is the Pechora Basin in the extreme northeastern part of the European USSR. Remoteness and severe climatic conditions are major disadvantages, and mining is handicapped by faults, 13/ excessive quantities of gas, 14/ and the necessity for leaving large pillars of coal for roof support. 15/ Currently, coals from the Vorkuta and Khalmer-Yu areas of the Pechora Basin are being supplied to coke plants at Cherepovets (1,900 km) and Leningrad (2,400 km). 16/ When a railroad is built to the Urals, coking coals from the Pechora Basin will displace much of the coal that has to be imported by the large coke and metallurgical combines in the Urals from the Karaganda Basin (1,200 km) and the Kuznetsk Basin (1,800 km to 2,300 km). 17/ It is unlikely, however, that Pechora coals will be delivered to the Urals during the present Seven Year Plan (1959-65).

Significantly the Urals Region (VIII) has no coals that can be used to produce coke for ferrous metallurgy. 18/ Although reserves in the Kizel Basin are estimated at 1 billion tons, mining conditions are exceptionally difficult, and the deposits consist mainly of steam-fat coals that are very high in sulfur (up to 6 percent). 19/ Coke produced locally from these coals at the Gubakha coke plant is used to smelt copper. 20/

East of the Urals, huge reserves of coking coals are found in the Karaganda and Kuznetsk Basins. The latter basin probably is second only to the Appalachian coalfields in the US as a potential source of coking coals. In 1955 the reserves in seams of minable thickness ("conditional" reserves) were estimated at 804 billion tons in the Kuznetsk Basin and 47 billion tons at Karaganda. 21/ In the Kuznetsk Basin, however, strongly caking coals represent a very minor share of the reserves to a depth of 300 meters -- 2.8 percent for coking (type K), 10 percent for lean-caking (type PS or OS), and 5.6 percent for steam-fat

(type PZh) coals.* 22/ The imbalance in the reserves of steam-fat coals has forced the coke plants to use considerable quantities of weakly caking (type SS) coals. 24/ It is notable that coke made from Kuznetsk coals is much weaker than that obtained from Donets coals. 25/ In ash and sulfur content, however, Kuznetsk coals are, in general, lower than other Soviet coals, but their phosphorous content is excessive. 26/

In the Prokopyevsk area, the major source of coking coals in the Kuznetsk Basin, mining conditions are very difficult. Although the seams usually are thick, they are steeply pitching (averaging about 70°), and, consequently, the efficiency of operations is considerably reduced. The coals are extremely friable and easily subject to spontaneous combustion. In addition, working conditions are so hazardous as to require special safety precautions because of the large quantities of gas in the mines. 27/

In the Karaganda Basin the USSR also must contend with some serious operating problems, in spite of the generally favorable thickness of the seams (2 to 8 meters), the relatively minor dip of the beds over large areas, and the nearness to the surface. 28/ Operations are handicapped by weak roof conditions and gas, which have prevented the USSR from obtaining a high level of productivity. It is notable that almost three-fourths of the Karaganda mines are rated as highly gaseous in comparison with 26 percent for all underground mines in the USSR. 29/ Karaganda coals generally have a high content of incombustible matter that is difficult to remove in cleaning plants.

The other deposits of coking coals that are mined currently will continue to have only minor importance. In the Georgian SSR (Region V) the mines at Tkvarcheli and Tkibuli supply, respectively, steam-fat and gas coals that can be used only to a very limited degree in blends with Donets coals at the coke plant located at Rustavi. 30/ Reserves in the Georgian deposits are relatively small, the coals are extremely high in ash, and mining conditions are unusually difficult. 31/

Deposits in the Far East, at Suchan and on Sakhalin Island, are relatively small and among the most expensive to mine in the USSR. Only a minor part of the Sakhalin coals are suitable for coking. 32/ The limited potentialities of these deposits are indicated by the need to send large quantities of coking coals from the Kuznetsk Basin to satisfy export quotas to Japan. It is notable that the Japanese have complained about the quality of all the coking coals from the eastern deposits and are willing to pay much higher prices for US coals. 33/

* Another source furnishes the following distribution: 2.5 percent of type K, 5 percent of type PS (OS), and 3.8 percent of type PZh. 23/

The deposits near Noril'sk, located in a remote area in East Siberia, are of local importance and are a source only of minor quantities of coking coal for the coke plant of the Noril'sk Metallurgical Combine (a smelter of copper-nickel-cobalt ores).

Of future interest will be the South Yakutian deposits in East Siberia, which have sizable reserves, now estimated at 40 billion tons of strongly caking coals (types K, PS, and PZh). These deposits are near large deposits of high-grade iron ore, but they are situated about 400 km from a railroad. 34/ Only a small production of coal in the area was reported in 1960.

B. Production of Coking Coal

1. Raw (Run-of-Mine) Coal*

According to the directives of the Seven Year Plan, the total production of coal in the USSR is to be increased about 22 percent, or from 496.1 million tons in 1958 35/ to between 600 million and 612 million tons in 1965.** 36/ Output of coking coal, however, is scheduled to jump from 94.4 million tons in 1958 to 150 million to 156 million tons in 1965, a gain of 59 to 65 percent. 37/ By 1965, coking coals will represent about 25 percent of the total production of coal in comparison with less than 20 percent in 1958. Data on the growth in Soviet production of coal are given in Table 1.***

In 1960, production of coking coals reached 110.2 million tons, about 9 percent more than in 1959 (100.8 million tons). 38/ The plan called for an increase of only 7 percent, 39/ indicating overfulfillment by 2.2 million tons. Although the 1961 Plan calls for the total production of coal to decline to 511.7 million tons 40/ from 513 million tons in 1960, 41/ indications are that production of coking coal will continue to increase. The cutback in production will be in energy coals, as a result of the planned shift in the national fuel balance from coal to oil and gas. The prospects for exceeding the 1965 goal for coking coals are considered to be favorable, although more manpower and longer working hours may be required than were planned.

Of the total output of coking coal in 1960, 92 percent was provided by the Donets, Kuznetsk, and Karaganda Basins -- the remainder (8.4 million tons) came from the Pechora and Kizel Basins, the Tkvarcheli

* Data in this section represent production before processing.

** It is possible that the total production of coal in 1965 may not reach this objective, inasmuch as original targets for 1960-61 have been lowered substantially but apparently have involved only energy coals.

*** Table 1 follows on p. 12.

Table 1

Production of Coking Coal in Relation to Production of Bituminous and Total Coal in the USSR
Selected Years, 1940-60, and 1960 and 1965 Plans

Year	Total Coal (Thousand Metric Tons)	Of Which		Coking Coal as a Percent of	
		Bituminous Coal	Coking Coal	Total Coal	Bituminous Coal
1940	165,923 a/	103,572 a/	35,333 a/	21.3	34.1
1945	149,333 a/	81,815 a/	29,773 b/	19.9	36.4
1950	261,089 a/	143,452 a/	51,697 b/	19.8	36.0
1955	391,259 a/	215,857 a/	77,440 b/	19.8	35.9
1956	429,174 a/	236,763 a/	82,966 a/	19.3	35.0
1957	463,470 a/	255,970 a/	87,551 a/	18.9	34.2
1958	496,112 a/	274,902 a/	94,407 a/	19.0	34.3
1959	506,557 a/	285,862 a/	100,805 a/	19.9	35.3
1960	513,194 c/	296,920 c/	110,198 c/	21.5	37.1
1960 Plan	515,000 d/	295,000	108,000 d/	20.9	36.6
1965 Plan	600,000 to 612,000 e/	N.A.	150,000 to 156,000 e/	25.0 to 25.5	N.A.

a. 42/
b. 43/
c. 44/
d. Estimate based on planned increases of 1.7 percent for total coal and 7 percent for coking coal in comparison with 1959. 45/
e. 46/

and Tkibuli deposits in the Georgian SSR, and the deposits near Noril'sk in East Siberia.* Production in the four major basins was as follows (in million tons): Donets, 64.9; Kuznetsk, 28.5; Karaganda, 8.3; and Pechora, 3.8. 47/ According to the Seven Year Plan, production of coking coals will rise to between 78.3 million and 84 million tons in the Donets Basin, to 41.5 million tons in the Kuznetsk Basin, 48/ to 19.7 million tons in the Karaganda Basin, 49/ and to 5.4 million tons in the Pechora Basin.**

The emphasis on production of coking coal in the USSR and in the four major basins that provide bituminous coal can be seen from the following percentage increases in planned growth during the Seven Year Plan (1958 = 100) 50/:

	Percent		
Area	Total Coal	Coking Coal	Energy Coal
Donets Basin	24.0	43.6 to 54.1	11.0
Kuznetsk Basin	36.8	61.3	3.9
Karaganda Basin	58.8	198.8	6.8
Pechora Basin	13.0	112.0	4.9***
USSR	20.9 to 23.4	58.9 to 65.2	12.1 to 13.6

Significantly, production of coking coals in the Donets Basin is heavily concentrated in the Stalino economic area (Stalinskaya Oblast), which is reported to account for about 50 percent of the entire Soviet production of these coals. The Stalino area supplied about 50 million tons in 1959, or 85 percent of the total quantity of coking coals mined in the Donets Basin. In 1959 the total production of coal in the Stalino area amounted to 89.04 million tons, 51/ 56 percent of which consisted of coking coals. The remainder of the coking coal produced in the Donets Basin came from the Lugansk economic area (Luganskaya Oblast) in the Ukraine (5.5 million tons) and from Rostovskaya Oblast in the RSFSR (3.4 million tons).

With few exceptions, currently exploited deposits will continue to provide the bulk of the coking coal produced during the Seven

* Soviet statistics usually do not include minor production at Suchan (near Vladivostok) and on Sakhalin Island in the Far East, which is exported to Japan.

** Soviet statistics on production of coking coal represent the raw coal destined for use at coke plants and include minor quantities of types not classified as coking coals.

*** Decrease (800,000 tons).

Year Plan. In 1965 the Ukrainian parts of the Donets Basin are expected to produce a minimum of 75.5 million tons of coking coal, or about one-half of the total output planned for the USSR. This production includes 9.5 million tons from the Lugansk area. An estimated total of 5.6 million tons will be mined in Rostovskaya Oblast. In the Pechora Basin, expansion will occur in the vicinity of Khalmer-Yu in order to obtain type K coking coals. In the Karaganda Basin the major new developments are in the Tentek, Churubay-Nura, and Shakhan areas. 52/ The Tom-Usinsk area in the Kuznetsk Basin is another new source of coking coal. 53/

The planned expansion for output of coking coal depends greatly on the successful completion of new mine construction and on modernization of the old mines. According to the Seven Year Plan, 149 new mines with an annual capacity of 108 million tons are to be placed in operation by the end of 1965 for production of coking coal. In contrast, only 98 new mines with a capacity of 48 million tons were placed in operation during the previous 7-year period (1952-58). 54/ As in the past, construction of new mines will be predominantly in the Donets, Kuznetsk, and Karaganda Basins. Elsewhere, only 16 mines with an annual capacity of about 7 million tons are scheduled to be built. In view of the lag in mine construction that has existed throughout the postwar period, there are good reasons to believe that over-all plans for new mine construction during 1959-65 may not be met. By concentrating construction efforts on mines for coking coals, however, this part of the mine construction program may be attained. Data for mine construction in the major basins during 1952-58 and 1959-65 are given in Table 2.*

The USSR is entirely self-sufficient in production of coking coal and has gradually increased exports of these coals, although shipments have represented a relatively minor part of supplies. In the event that there are marked increases in the demand for coking coal in the European Satellites whereby those countries are compelled to depend more heavily on the USSR, the USSR, if necessary, can increase production of coking coals considerably above planned levels simply by employing more workers or by increasing the working time. Because the average workweek has been reduced from 48 to between 35 and 40 hours, there is some leeway for raising production above planned levels through an increase in the hours of employment. There is a problem, however, relating to quality. It is believed that the USSR may have some difficulty in furnishing foreign countries with the types of coal that they require.

2. Prepared Coal

The objectives of the preparation of coking coal are to improve the quality of the coke and pig iron as well as the efficiency of both the coke plants and the blast furnaces. Except for minor quantities,

* Table 2 follows on p. 15.

Table 2

Construction of New Mines and Annual Capacity in Major Coal Basins of the USSR a/
1952-58 and 1959-65 Plan

Area and Type of Coal	1952-58		1959-65 Plan		1959-65 as a Percent of 1952-58	
	Number of New Mines	Total Annual Capacity (Million Metric Tons)	Number of New Mines	Total Annual Capacity (Million Metric Tons)	Number of New Mines	Total Annual Capacity
Donets Basin						
Coking coal	58	18.9	82	43.2	141	229
Energy coal	326	54.0	55	27.6	17	51
Total	384	72.9	137	70.8	36	97
Kuznetsk Basin						
Coking coal	18	17.1	27	32.7	150	191
Energy coal	44	11.2	19	7.5	43	67
Total	62	28.3	46	40.2	74	142
Karaganda Basin						
Coking coal	12	9.2	24	24.5	200	266
Energy coal	8	1.4	2	1.5	25	107
Total	20	10.6	26	26.0	130	245
Other Basins						
Coking coal	10	3.2	16	7.2	160	225
Energy coal	251	69.8	117	73.0	47	105
Total	261	73.0	133	80.2	51	110
Total USSR						
Coking coal	98	48.4	149	107.6	152	222
Energy coal	629	136.4	193	109.6	31	80
Total	727	184.8	342	217.2	47	118

a. 55/. Excluding mines operated by local industries.

Soviet coals require preparation, including screening,* mechanical cleaning,** drying (in some cases), and crushing, before they are suitable for coking. Mechanical cleaning refers to cleaning raw coal with mechanical devices*** that not only reduce the natural impurities in the coal -- rock and sulfur -- but also eliminate extraneous matter, such as iron and wood, that may be mixed with the coal during mining. The general practice of cleaning coal in washeries increases the moisture in the coal, especially in the fine sizes, to an extent that most of the coal should be dried to prevent freezing and to improve the operation of the ovens and the quality of the coke.† Crushing facilitates the blending of dissimilar coals for obtaining uniformity in the mixture and contributes to an increase in the mechanical strength of the coke. As a rule, about 90 percent†† of the coal in the charge at coke ovens is composed of sizes not exceeding 3 mm.

In order to produce metallurgical coke of high quality, the USSR strives to utilize coal with a maximum ash content of 7 percent and a minimum of sulfur. Only the Kuznetsk coals, however, may be classified as low in sulfur -- averaging about 0.5 to 0.6 percent. Some of the Karaganda and Vorkuta coals also are low in sulfur, but their average is closer to 1 percent. Generally speaking, more than 1 percent sulfur content in coal is considered excessive. Donets coals, however, average about 2.3 percent sulfur, which is reduced to slightly more than 2 percent by cleaning -- the average was 2.04 percent during 1956-58. 56/ Considerable quantities of Donets coals are used that contain more than 3.5 percent sulfur in the raw coal, and much more of these coals could be used for coking purposes if it were possible to reduce the sulfur sufficiently. Cleaning serves to eliminate some of the free sulfur in the form of pyrites and sulfates, but it is impossible to eliminate organic (inherent) sulfur, which is high in many of the Donets coals. In spite of the undeniably high sulfur content of Donets coals, the USSR is forced

* Screening, or the sizing of coal, is referred to as sorting in Soviet usage.

** The cleaning of coal is commonly called concentration in Soviet usage, but the use of the term sometimes implies that the processing includes crushing and drying. References to concentration in this report will be in the restricted sense to mean cleaning only.

*** In 1958 the total quantity of coal handled in cleaning plants was processed by the following methods: 64 percent by wet methods, 30 percent by pneumatic methods, and 6 percent by a combination of wet and dry methods.

† In spite of the advantages of drying, it seems that the Soviet preparation plants have extremely limited facilities for this process.

†† At the Ukrainian plants that use Donets coals, the proportion of sizes less than 3 mm in the charge has been as follows: 1940, 75 to 80 percent; 1948, 82 to 87 percent; and 1958, 90 to 91 percent.

to use them to make coke because better coals are not available. Kizel coals contain an average of 6 percent sulfur and are therefore unsuitable for making metallurgical coke.

In the process of mechanical cleaning at Soviet plants, three types of products result: concentrates (cleaned coal), which are low in ash; intermediate products, or middlings, which generally have an ash content of 40 to 50 percent; and refuse, which consists mostly of rock and has an ash content of 80 to 90 percent.* The refuse contains some coal that is wasted. The middlings generally are suitable only for use at power stations, although further cleaning can provide a product with lower ash, which is more satisfactory as an energy fuel for other consumers but involves an additional loss of coal. The yield of concentrates varies widely, depending on the content of impurities in the raw coal, the difficulty of cleaning, the ash content desired, and the efficiency and type of facilities for cleaning. Coals with a high content of organic impurities are difficult to clean and contribute to low yields of concentrates.

Because of the generally high content of ash in the Soviet coals, the yield of concentrates is relatively low, except for the Kuznetsk coals. Moreover, only minor quantities of the concentrates meet the standard for 7 percent ash content 57/ because the USSR has had neither the necessary basic quality of raw coal available nor the cleaning facilities to attain this standard of quality. A comparison of ash content and yields of concentrates at coking plants operated in the three major coal basins in 1956 is as follows 58/**:

	Percent		
	Donets Basin***	Kuznetsk Basin	Karaganda Basin
Ash content of raw coal	20.2	12.5	18.8
Yield of concentrates	61.5	85.0	55.2
Ash content of concentrates	7.3	8.1	9.8

* In the US, because of the high ash content of the other products, only the concentrates would be used.

** Data for subsequent years would be approximately the same as for 1956.

*** Because of the high sulfur content of Donets coals, it is necessary to obtain a lower ash content than with Kuznetsk and Karaganda coals. The 1960 Plan called for an ash content of 7.2 percent at cleaning plants operated in the Stalinskiy Sovnarkhoz. 59/

The lack of adequate cleaning facilities represents an important economic deficiency that has restricted the supply of coal available for the coke plants. In 1958, the latest year for which data are available, the USSR processed 136.1 million tons of raw coal, including 86.2 million tons (91.3 percent of the output) of coking coal. 60/ The volume of concentrates available for coking purposes is estimated at only 60 million tons in 1958, representing a yield of about 70 percent. According to the 1965 Plan, the volume of coking coal to be processed at cleaning plants will increase to about 149 million tons, 61/ a gain of about 72 percent. Practically all of the output of coking coal, therefore, is planned to be processed. The program calls for the construction of 63 new plants to process coking coal, with a total capacity of 88 million tons. Fulfillment of the plan will necessitate the construction of more than twice as many of these plants as were built during 1952-58, and their total capacity will increase by 125 percent. It is notable that the USSR has contracted with French companies to build five plants, including three plants in the Donets Basin. 62/ In addition, West Germany will furnish two plants. Data on coal processing and construction of cleaning plants are given in Table 3.*

The USSR in 1960 planned to process an estimated total of 100 million tons of coking coal with a yield of concentrates of approximately 70 million tons. Significantly the yield of concentrates has been declining because of the increasing quantities of impurities in the coal, resulting mainly from mechanical loading. The average ash content of all hard coal now exceeds 16 percent. During 1952-55 the yield of concentrates of coking coal declined from 76.4 to 72.2 percent, 63/ and it is doubtful that the yield exceeded 70 percent in 1960. By 1965, however, some improvement may be expected because more attention is being given to installation of flotation equipment, which will permit better recovery of the very small sizes (less than 0.5 mm) that are lost in the sludge, especially at the plants that process Donets coals.

In order to realize the 1965 Plan for processing 149 million tons of coking coal, the annual rate of growth will have to average about 9 million tons, contrasting with about 7 million tons in recent years. If the Soviet authorities encounter too many difficulties in the construction of cleaning facilities, it is probable that more emphasis will be given to coking coal and that any shortfall will be with respect to energy coals. It is estimated, therefore, that the quantity of clean coal available for coking in 1965 will amount to about 110 million tons, assuming a yield of 74 percent.

Coking coals are processed both at plants operated in conjunction with coke plants and at plants situated in the vicinities of

* Table 3 follows on p. 19.

Table 3

Volume of Coal Cleaned and Construction of New Cleaning Plants in the USSR a/*
1952-58 and 1959-65 Plan

Area and Type of Coal	Million Metric Tons of Coal Cleaned			New Cleaning Plants				New Capacity to Be Installed 1959-65 as a Percent of 1952-58
				1952-58		1959-65 Plan		
	1958	1965 Plan	1965 as a Percent of 1958	Number	Capacity (Million Metric Tons)	Number	Capacity (Million Metric Tons)	
Ukrainian SSR								
Coking coal b/	47.4	74.2	157	12	18.1	29	31.6	175
Energy coal	16.1	64.4	400	13	9.1	25	29.0	319
Total	63.5	138.6	218	25	27.2	54	60.6	223
Kazakh SSR								
Coking coal c/	5.5	12.8	233	2	1.3	5	9.8	754
Energy coal	1.7	6.4	376	0	1.2	4	10.2	850
Total	7.2	19.2	267	2	2.5	9	20.0	800
RSFSR								
Coking coal d/	30.9	58.9	191	15	18.1	27	46.1	255
Energy coal	32.1	88.4	275	15	18.3	13	34.4	188
Total	63.0	147.3	234	30	36.4	40	80.5	221

* Footnotes for Table 3 follow on p. 20.

Table 3

Volume of Coal Cleaned and Construction of New Cleaning Plants in the USSR a/
1952-58 and 1959-65 Plan
(Continued)

Area and Type of Coal	Million Metric Tons of Coal Cleaned			New Cleaning Plants				New Capacity to Be Installed 1959-65 as a Percent of 1952-58
				1952-58		1959-65 Plan		
	1958	1965 Plan	1965 as a Percent of 1958	Number	Capacity (Million Metric Tons)	Number	Capacity (Million Metric Tons)	
Other Republics								
Coking coal e/	2.4	2.7	112	1	1.6	2	0.3	19
Energy coal	0	0	0	0	0	0	0	0
Total	2.4	2.7	112	1	1.6	2	0.3	19
Total USSR								
Coking coal	86.2	148.6	172	30	39.1	63	87.8	225
Energy coal	49.9	159.2	319	28	28.6	42	73.6	257
Total	136.1	307.8	226	58	67.7	105	161.4	238

a. 64/
b. Donets coals.
c. Karaganda coals.
d. About 70 percent of the volume cleaned in 1958 consisted of Kuznetsk coals; the remainder included Donets coals (Rostov Oblast), Kizel coals, and possibly some Pechora coals.
e. Georgian coals.

the mines. In 1958, about two-thirds of the coal was processed at mine plants, as indicated by data in Table 4. In 1958, Donets coals for coking were cleaned at 32 preparation plants, 12 of which were integrated into coke-chemical works; 6 were central washeries; 9 served a group of local mines; and 5 were individual operations, each serving one mine. Nearly 46 percent of the total output of concentrates from Donets coals was produced at plants located at the coke works. The maximum capacity of the preparation plants located outside the coke works is about 400 tons per hour, whereas inside these works the capacity generally ranges from 500 to 800 tons per hour. In 1958, about 50.5 million tons of Donets coking coals were processed, and the yield of concentrates is estimated at 34.4 million tons. 65/

Table 4

Volume of Coking Coal Processed at Cleaning Plants in the USSR a/
1940 and 1950-58

Million Metric Tons

Year	At Coke Plants	At Mine Plants	Total
1940	16.4	6.8	23.2
1950	17.7	20.6	38.3
1951	18.7	23.9	42.6
1952	19.4	28.5	47.9
1953	19.5	32.8	52.3
1954	20.3	40.4	60.7
1955	21.5	47.7	69.2
1956	23.3	51.4	74.7
1957	25.2	55.2	80.4
1958	28.6	57.6	86.2

a. 66/

Of 28 coal preparation plants in the Kuznetsk Basin, 27 processed coking coal (21 million tons), and their production probably was less than 17 million tons of concentrates in 1958. At Karaganda, five plants with a total capacity of 4.05 million tons of raw coal 67/ probably supplied about 2.2 million tons of concentrates in 1958. The yield of concentrates in Georgian plants is very low (30 to 50 percent). Of 2.4 million tons of coking coal processed in that region (V) in 1958, the yield of concentrates was only about 1.1 million tons. The coal, as mined, averages from 43 to 47 percent ash content. 68/ The balance of

the coking coal in 1958 was processed mainly in the Urals and consisted for the most part of coals imported from the Kuznetsk Basin. Some Karaganda and Kizel coals also are processed for coking purposes. It is estimated that the preparation plants in the Urals (Magnitogorsk, Nizhniy Tagil, Gubakha, and others) processed about 5 million tons and that the yield of concentrates amounted to 3.2 million tons.

It is estimated that approximately 80 million tons of Donets coking coal will be processed in 1965 and that the yield of concentrates will amount to 60 million tons, a gain of nearly 75 percent in comparison with 1958. This estimate is based on Soviet expectations of much better yields of concentrates. Production of concentrates from Kuznetsk and Karaganda coals is estimated at 34.3 million tons and 7.7 million tons, respectively, representing increases of 95 and 157 percent in comparison with output in 1958. In the Urals it is expected that about 9.5 million tons of coking coal concentrates will be produced. According to Soviet authorities, about 5 million tons of Karaganda coal will be processed at Ural plants in 1965. 69/ Expansion at Georgian plants will be minor. Data on the processing of coking coal and on estimated yields of concentrates according to the sources of coal for 1958 and 1965 are given in Table 5.*

3. Coal, by Type

The most valuable coals for coking purposes are bituminous coals with a low to medium content of volatile matter, in the range of 18 to 27 percent, that form a strong, dense coke when carbonized at high temperatures. Such coals are designated as type K in the USSR, and generally they can be transformed into high-quality metallurgical coke without the need for blending with other types. The relative scarcity of these coals in the USSR, however, precludes their use exclusively, and they are always blended with other types.

In contrast with coke plants in the US and Western Europe that generally are required to blend coals from only 2 or 3 mines, a Soviet plant is forced to mix coals of different types from 10 to 90 mines. The Kuznetsk Coke Plant in West Siberia, for example, uses coal from 10 local mines. 70/ The blending situation is especially critical in the Ukraine, where it is necessary to use coals from many more mines than planned, as indicated by the following data on the number of mines furnishing coking coal to certain Ukrainian cokeries 71/:

* Table 5 follows on p. 23.

Plant	Planned	Actual
Kadiyevka	14	25
Gorlovka	13	19
Alchevsk	25	36
Dnepropetrovsk	17	90
Dneprodzerzhinsk	25	77
Zaporozh'ye	24	48

Table 5

Coal Cleaned and Production of Concentrates for Coking Purposes in the USSR 1958 and 1965 Plan

Source of Coal	Coal Cleaned a/		Production of Concentrates			
			1958		1965 Plan	
	1958 (Million Metric Tons)	1965 Plan (Million Metric Tons)	Million Metric Tons	Percent of Yield	Million Metric Tons	Percent of Yield
Donets Basin	50.5	79.8	34.4	68 b/	60.0	75 c/
Pechora Basin	3.3	7.2	2.5	76 c/	5.4	75 c/
Georgian SSR	2.4	2.6	1.1	46 d/	1.2	46 d/
Kizel Basin	2.2	2.2	1.4	64 c/	1.4	64 c/
Karaganda Basin	5.5	12.8	3.0	55 e/	7.7	60 c/
Kuznetsk Basin	22.3	44.0	17.6	79 f/	34.3	78 c/
Total	86.2	148.6	60.0	70	110.0	74

50X1

b. Estimate based on the 1957 yields of 79.5 percent at plants operated by ferrous metallurgical combines and of 60.7 percent at plants operated in the coalfields. 73/ The latter plants account for two-thirds of the coal cleaned.

c. 74/

d. Estimate based on yields of 50 percent at Tkibuli and 30 percent at Tkvarcheli. 75/

e. The yield was 55.2 percent in 1956. 76/

f. Estimate based on the 1957 yield of 79.4 percent. 77/

The superior grades of coking coals (type K) represent only a minor part of production in the Donets and Kizel Basins, and none is produced in the Georgian SSR or at Noril'sk. There has been no production of type K coals in the Pechora Basin until the recent commencement of operations at Khalmer-Yu. On the other hand, most of the coal produced at Karaganda and a substantial part of the Kuznetsk coals consist of type K.

Although the higher volatile (type PZh) and lower volatile (type PS) coals are less desirable for coking purposes, each type can be used to make good coke when blended with other types. A major part of the coal produced for coking in the Donets, Pechora, and Kizel Basins and at Noril'sk and Tkvarcheli (Georgian SSR) is type PZh.

In recent years, almost 32 percent of the Kuznetsk coals produced for coking needs also have been of type PZh. At Karaganda, most of the expansion in production of coal will consist of type PZh. The lower volatile coals (type PS) are produced only in the Donets and Kuznetsk Basins, where they represent a minor share of production. Available data on production of coals, by types, in various parts of the USSR during recent years and that planned for 1960 and 1965 are given in Table 6.*

Inasmuch as the supplies of the preferred types of coking coals have been inadequate, it has been necessary to use minor quantities of weakly caking and noncaking coals in blends. Insofar as the eastern coke plants are concerned, supplies of the better grades of coking coal are not a serious problem, but there has been a trend to the greater use of high-volatile gas coals (type G) at western cokeries during the postwar period. Not only do gas coals present problems in blending and plant operation, but also their use lowers the yields of coke and results in weaker coke. Such coals represented 19 percent of the output of Donets coals used for coking purposes in 1958, but it is expected that, in time, the figure will exceed 25 percent. Significantly, 39 of the new mines, nearly 60 percent to be constructed in the Donets Basin during the 1961-65 period, will produce gas coals. The relative importance of various types of coal in the total output of bituminous coal in the Donets Basin is indicated by the following data for 1957 and the 1960 Plan 78/:

* Table 6 follows on p. 26.

Type of Coal	Percent 1957	Percent 1960 Plan
Long-flame (D)	9.0	8.1
Gas (G)	26.1	27.0
Fat (PZh)	25.9	25.3
Coking (K)	12.0	11.4
Lean caking (PS or OS)	9.0	9.8
Lean (T)	18.0	18.4
Total	100.0	100.0

C. Production of Coke and Byproducts

1. Coke

The USSR has been expanding its coke industry at a rapid pace and ranked first in world output during 1958-60.* During the decade 1950-59, production of coke in the USSR increased from 27.7 million tons to 53.4 million tons,** or 92.8 percent. 80/ The 1960 Plan called for production to reach 57 million tons, 81/ but actual production amounted to only 56.2 million tons. 82/ It is estimated that 81 million tons will be produced in 1965, or slightly more than that called for by the Seven Year Plan -- 76 million to 80.6 million tons. 83/

In 1960, production of coke in the Western Regions (I-VII) amounted to about 35 million tons, of which about 30 million tons were produced in the Ukraine. During the Seven Year Plan, more emphasis will be given to expansion of coke production at plants in the Eastern Regions (VIII-XII), which are expected to account for 43 percent of the total production in 1965 84/ compared with 39 percent in 1960, representing an increase from 22 million to about 35 million tons. The major development will be construction of coking facilities at the Kazakh Metallurgical***

* US production of oven and beehive coke (excluding breeze) was as follows (in million metric tons): 1955, 68.3; 1956, 67.6; 1957, 68.9; 1958, 48.6; 1959, 50.7; and 1960, 51.9. The low rate of operations in the iron and steel industry during 1958-60 caused production of coke to drop far below capacity. 79/

** Soviet figures are reported for gross coke having a moisture content of 6 percent. The figures apparently do not include breeze. Breeze constitutes the sizes of less than 10 mm in Western Europe and less than 0.5 inch in the US. Such sizes have limited use and usually are not included in production.

*** Text continued on p. 28.

Table 6

Production of Coking Coal for Use at High-Temperature Coke Plants in the USSR
1955, 1958-59, and 1960 and 1965 Plans

Area and Type of Coal	1955		1958		1959 (Thousand Metric Tons)	1960 Plan (Thousand Metric Tons)	1965 Plan (Thousand Metric Tons)
	Thousand Metric Tons a/*	Percentage Distribution	Thousand Metric Tons	Percentage Distribution			
Donets Basin							
Type K	10,700	24	12,702 b/	23	N.A.	N.A.	N.A.
Type PZh	19,160	43	22,515 b/	41	N.A.	N.A.	N.A.
Type PS	6,220	14	8,340 b/	15	N.A.	N.A.	N.A.
Type G	7,580	17	10,358 b/	19	N.A.	N.A.	N.A.
Type D	330	1	273 b/	1	N.A.	N.A.	N.A.
Type T	410	1	327 b/	1	N.A.	N.A.	N.A.
Total	44,400	100	54,515 c/	100	58,852 c/	63,000 d/	81,100 e/
Kuznetsk Basin							
Type K	6,390	30	6,038 f/	23	N.A.	N.A.	N.A.
Type K_2	4,060	19	5,930 f/	23	N.A.	N.A.	N.A.
Type PZh	6,790	32	8,200 f/	32	N.A.	N.A.	N.A.
Type PS	980	4	1,785 f/	7	N.A.	N.A.	N.A.
Type SS	1,050	5	818 f/	3	N.A.	N.A.	N.A.
Type G	2,130	10	2,955 f/	12	N.A.	N.A.	N.A.
Total	21,400	100	25,726 f/	100	26,904 c/	28,000 g/	41,500 h/
Karaganda Basin							
Type K	N.A.	N.A.	3,594 i/	54	3,800 i/	N.A.	6,100 j/
Type K_2	N.A.	N.A.	2,500 i/	38	2,700 i/	N.A.	6,600 j/
Types PZh and KZh	N.A.	N.A.	500 i/	8	565 i/	N.A.	7,000 j/
Total	6,700	100	6,594 c/	100	7,065 c/	8,600 d/	19,700 j/

* Footnotes for Table 6 follow on p. 27.

Table 6

Production of Coking Coal for Use at High-Temperature Coke Plants in the USSR
1955, 1958-59, and 1960 and 1965 Plans
(Continued)

Area and Type of Coal	1955		1958		1959	1960 Plan	1965 Plan
	Thousand Metric Tons a/	Percentage Distribution	Thousand Metric Tons	Percentage Distribution	(Thousand Metric Tons)	(Thousand Metric Tons)	(Thousand Metric Tons)
Pechora Basin	930	k/	2,547 c/	k/	3,206 c/	3,700 d/	5,400 l/
Kizel Basin	2,080	m/	2,216 c/	m/	2,121 c/	2,100 n/	2,200 o/
Georgian SSR	1,930	p/	2,374 c/	p/	2,252 c/	2,200 n/	2,600
East Siberia	0		435 c/	q/	405 c/	400 n/	500
Total USSR	77,440		94,407 c/		100,805 c/	108,000 r/	153,000 s/

a. 85/

c. 87/

d. Planned increases in comparison with 1959: Donets, 7 percent; Karaganda, 22 percent; Pechora, 14.5 percent. 88/

e. Estimate based on the goal of the Seven Year Plan of 78.3 million to 84 million tons. In the Ukrainian part of the Donets Basin, production will be 75.5 million tons. 89/ In Rostovskaya Oblast, production of coking coal will increase 2.5 million tons above 1958, representing an increase of 83 percent. 90/

f. 91/

g. Estimate based on the total production of coal increasing only 4 percent.

h. 92/

i. Estimate based on the 1959 Plan, which called for production of the following amounts of different types of coal (in million tons): type K, 3.5; type K_2, 2.5; and types PZh and KZh, 0.5. 93/

j. 94/

k. Nearly all type PZh from the area of Vorkuta.

l. 95/

m. Nearly all type PZh coal.

n. Estimate based on 1959 production.

o. Estimate based on the total output at Kizel being only 98 percent of the 1958 level.

p. The total output of bituminous coal is about equally divided between Tkvarcheli (type PZh) and Tkibuli (type G) fields.

q. Probably type PZh.

r. A 7-percent increase above 1959. 96/

s. Midpoint of the range of production for the 1965 Plan of 150 million to 156 million tons. 97/

50X1

Combine near Karaganda (Region Xa) and the Zapadno-Sibirskiy Metallurgical Combine in the Kuznetsk Basin (Region IX). Data on selected regional production of coke in the USSR are given in Table 7.*

With the exception of two low-temperature carbonization plants,** all of the Soviet coal utilized to produce coke is carbonized in high-temperature (900° to 1,000° C) installations. The industry comprises 42 plants, which are large, modern in design, and equipped with the conventional slot type of byproduct ovens. There are 38 major plants producing metallurgical coke. Most of these plants are operated in conjunction with iron and steel works, but there are others, generally located in the coal mining districts, that are referred to as coke-chemical plants. It is believed that the coke-chemical plants probably are primarily interested in the chemicals that can be obtained from the coke-gas, tar, benzene, and ammonia water. In addition to the 38 major coke plants, there are four plants, located in Moscow, Leningrad, Kaliningrad, and Odessa, that are essentially gas works furnishing some metallurgical coke as a byproduct. In 1958, [redacted] 71 percent of the coke was produced in plants that were a part of metallurgical combines, 10 percent came from plants that were combined with enterprises of the chemical industry, and 5 percent was from gas works. 98/ The balance of the coke (14 percent), presumably, came for the most part from plants controlled by the ferrous metallurgical industry but operated separately from the steel works. 50X1

The average capacity of the Soviet coke plants is nearly 1.5 million tons annually, which is to be compared with less than 1 million tons for plants in the US. 99/ The largest Soviet plant, at Magnitogorsk in the Urals, has an annual capacity of about 6 million tons, which is larger than any plant in the US with the exception of the Clairton Works (7.5 million tons) of the United States Steel Corporation. The distribution of production of coke in the USSR in 1958, the latest year for which comprehensive data are available, according to the annual capacity of the plants, was as follows 100/:

* Table 7 follows on p. 30.

** Insofar as can be determined, there are only two low-temperature (450° to 550° C) carbonization plants -- one in the Kuznetsk Basin and another near Cheremkhovo in East Siberia. Both of these plants, apparently, produce synthetic fuel. There have been no indications that the USSR produces medium-temperature coke (600° to 750° C).

Annual Plant Capacity (Thousand Tons)	Percent of 1958 Production
Up to 100	0.2
101 to 400	2.9
401 to 1,000	4.3
1,001 to 2,000	36.8
2,001 to 3,000	30.8
More than 3,000	25.0

Except for some plants in the central Ukraine; the plants in the Urals; the Cherepovets, Novo-Lipetsk, and Rustavi plants; and the four gas works, most of the plants are situated in close proximity to the coal mines. Nearly all of the western plants depend exclusively on Donets coals. These coals are hauled 400 to 600 km to plants in the central Ukraine, 1,200 km to Rustavi, and 1,700 km to the Leningrad gas works. Vorkuta coals move 2,400 km to Leningrad and 1,900 km to Cherepovets. The plants in the Urals, except for the plant at Gubakha, depend entirely on coals hauled long distances from the Karaganda Basin (1,200 to 1,500 km) and the Kuznetsk Basin (1,800 to 2,400 km). 101/ At those plants that depend on coal hauled long distances, the USSR attempts to maintain coal stocks sufficient for a month's operations, but the plants located near the mines usually have less than a week's supply on hand. It is notable that oxidation causes coking coal to deteriorate in quality, so that efforts are made to minimize the storage period. 102/

Although data on actual consumption of coal at the ovens have not been available since 1956, it is possible to provide reasonably good estimates for subsequent years. Reported data for 1950 and 1955-56 and estimates for 1957-60 and 1965 are given in Table 8.*

The consumption of dry coal per ton of dry coke produced averages about 1.3 tons for most coals -- the factor increases to between 1.36 and 1.4 on a wet basis.** The factors for the consumption of coal as well as the yields of coke, including breeze, on a dry basis are given in Table 9.*** The amount of breeze included in the coke yields is generally about 4 to 5 percent.

Metallurgical grades of coke (furnace coke) comprise the sizes larger than 40 mm, which are required in smelting ores in tall blast†

* Table 8 follows on p. 31.

** The moisture content of the coals charged at the ovens normally ranges from 8 to 10 percent.

*** Table 9 follows on p. 32.

† Text continued on p. 33.

Table 7

Production of Coke in the USSR, by Selected Economic Region a/
1950, 1955-60, and 1965 Plan

Thousand Metric Tons

Economic Region	1950	1955	1956	1957	1958	1959	1960	1965 Plan
Western Regions								
Ia Northwest	216	220	250	250	275	275	275	400
Ib North	0	86	585	1,021	1,250	1,505	1,550	5,600
IIa Baltic	0	0	180	180	215	270	270	400
III Ukraine	15,032 b/	23,661 c/	24,690 d/	25,557 d/	27,201 d/	29,161 b/	30,078	36,000
V Georgia	0	586 c/	721	748	759	739	750	1,000
VII Central	0	1,142 c/	1,167 e/	1,163 e/	1,164 e/	1,255	1,600	2,500
Subtotal	15,248	25,695	27,593	28,919	30,864	33,205	34,523	45,900
Eastern Regions								
VIII Urals	8,448 e/	12,990 e/	14,023 e/	14,720 e/	15,032 e/	15,100	16,122	21,300
IX West Siberia	3,857 e/	4,716 c/	4,741 e/	4,745 e/	4,742 e/	4,820	5,180	9,400
Xa Kazakh SSR	0	0	0	0	0	0	100	4,000
XI East Siberia	175	192 c/	243	250	256	275	275	400
Subtotal	12,480	17,898	19,007	19,715	20,030	20,195	21,677	35,100
Total USSR	27,728 f/	43,593 c/	46,600 g/	48,634 h/	50,894 g/	53,400 g/	56,200 i/	81,000 j/

a. Estimated unless otherwise indicated.
b. 103/
c. 104/
d. 105/
e. 106/
f. 107/
g. 108/
h. 109/
i. 110/. The plan called for 57 million tons. 111/
j. Upper limit of the range of the goal of the Seven Year Plan for 1965 of 76 million to 81 million tons. 112/

Table 8

Volume of Coal Utilized by High-Temperature Coke Plants in the USSR
Selected Years, 1950-60, and 1965 Plan

Million Metric Tons

Source of Coal	1950 a/	1955 a/	1956 a/	1957 b/	1958 b/	1959 b/	1960 b/	1965 Plan b/
Western Regions								
Donets Basin	22.4	36.0	37.0	39.0	40.5	43.5	46.2	55 to 62
Pechora Basin	0	0	1.0	1.5	2.2	2.4	2.6	3.5
Georgian SSR	0	0.5	0.6	0.7	1.1	1.1	1.2	1.5
Subtotal	22.4	36.5	38.6	41.2	43.8	47.0	50.0	60 to 67
Eastern Regions								
Kuznetsk Basin	12.7	17.9	20.1	20.1	20.5	21.0	23.0	38
Karaganda Basin	1.7	3.5	3.5	3.6	3.8	4.1	5.0	10
Kizel Basin	1.8	2.0	2.0	2.0	2.1	2.1	2.0	2
Subtotal	16.2	23.4	25.6	25.7	26.4	27.2	30.0	50
Total USSR	38.6	59.9	64.2	66.9	70.2	74.2	80.0	110 to 117

a. 113/
b. Estimated. In some cases the estimates are based on production of coke and yield of coke per ton of coal charged at the ovens and in other cases on the quantity of cleaned coking coal available. The yields of coke based on the source of the coal have been reported and show little variation from year to year.

Table 9

Coefficients of Consumption of Coal at Coke Plants in the USSR a/

Source of Coal	Consumption of Dry Coal per Ton of Dry Coke (Metric Tons)	Consumption of Coal per Ton of Coke of Normal Moisture b/ (Metric Tons)	Content of Natural Low-Ash Coal in the Charge (Percent)	Requirements of Raw Coal per Ton of Dry Coke (Metric Tons)	Average Yield of Dry Coke from Dry Coal Charged at Ovens (Percent)
Donets	1.310	1.398	5.0	1.833	76.3
Kuznetsk	1.300	1.380	c/	1.760	76.7
Karaganda	1.290	1.360	c/	2.270	77.7
Pechora	1.300	1.380	c/	1.840	76.7
Kizel	1.435	1.520	c/	2.323 d/	69.7 d/

a. 114/. Data probably are for 1958.
b. Normal moisture content is 6 percent.
c. Data are not available, although probably no such coals are used, except for Kuznetsk coals.
d. Mixture of Kizel and Kuznetsk coals.

furnaces. At the Chelyabinsk plant* in the Urals, approximately 87 percent of the coke produced consists of sizes exceeding 40 mm, but the yield of these larger sizes is only 76 percent at the Kuznetsk plant (Region IX), which utilizes blends of coal from local mines. Inasmuch as Donets coals provide stronger coke, it is assumed that the yield of furnace coke from these coals is close to 90 percent. Although precise data are lacking, it is probable that about 85 percent of the coke produced at Soviet coke plants consists of the sizes suitable for metallurgical purposes (larger than 40 mm).

2. Byproducts

It is estimated that in addition to coke the Soviet plants produced about 22.2 billion cubic meters of coke gas, between 2 million and 3 million tons of tar, 0.75 million tons of crude benzene, and a large quantity of ammonia in 1960.** These estimates are based on the assumption that all of the gas that is utilized, or 99 percent of the output, 117/ is stripped of tar, crude benzene, and ammonia liquor after it leaves the coke ovens. From these raw materials and the residual gas, the Soviet coke-chemical industry produced more than 60 products. In 1960, raw materials from the coke-chemical industry were used to produce more than 60 percent of the total output of plastics, chemical fibers, synthetic detergents, and other synthetic materials. Nevertheless, production of coke-chemicals falls far short of the potential yield of these products, and, in addition, the purity of some of these products is inadequate for production of certain valuable end products. In the next few years the USSR expects to be producing up to 100 items and more than 180 varieties of products based on raw materials from the coke plants. 118/

Significantly, before 1958 production of coke gas exceeded that of natural gas.*** Of approximately 20 billion cubic meters of coke

* This plant blends six grades of coal; about 65 percent consists of Kuznetsk coal, and the remainder comes from Karaganda. Such blending is considered to be typical of the other three plants in the Urals using imported coals exclusively. The size distribution of the Chelyabinsk plant is as follows: larger than 40 mm, 87 percent; 25 to 40 mm, 4 percent; 10 to 25 mm, 5 percent; and 0 to 10 mm, 4 percent. 115/

** In carbonization, each ton of dry coal charged at the ovens yields 70 to 80 percent (averaging about 77 percent) of coke, 14 to 20 percent of coke gas, 3 to 4 percent of tar, 1 percent of crude benzene, and 0.22 to 0.3 percent of ammonia liquor. 116/ The crude benzene, or light oil, contains benzene, toluene, xylene, and a number of solvents. The yield of coke gas is about 375 cubic meters per ton of coke, including breeze, that is produced.

*** In 1957, production of coke gas and natural gas were, respectively, 19.7 billion 119/ and 18.6 billion [footnote continued on p. 34]

gas produced in 1958, 57 percent was used at the iron and steel works, chiefly in heating the blast furnaces and open-hearth furnaces, and 27 percent was consumed at the coke plants, mainly to heat the ovens. The remainder of the gas, except for 1 percent that was lost, was distributed to other consumers, including about 5 percent of the total that was processed for chemicals. 123/

In contrast with the coke industry in the US and most Western countries, the USSR has lagged in production of end products that can be derived from intermediate chemicals that are obtainable from residual coke gas, tar, and crude benzene. The residual gas contains 55 to 60 percent hydrogen, 24 to 28 percent methane,. and 2 to 4 percent of unsaturated compounds such as ethylene and propylene. 124/ Soviet technologists claim that hydrogen produced from coke gas is about 12 percent cheaper than that extracted from natural gas. 125/ The limited quantities of residual coke gas that are now processed are used to obtain hydrogen for the synthesis of ammonia. 126/ Apparently, there is no production of acetylene, which could be obtained from the methane, and the yields of other products that could be derived from the residual gas are very small. Some ethylene is used, mainly in production of ethylbenzene. 127/ In 1965, some 4.1 billion cubic meters of coke gas, about 14 percent of the total output (30 billion cubic meters), are to be processed into ammonia and other chemicals. 128/

Coal tar and benzene are valuable raw materials for organic synthesis, particularly for producing polymers, naphthalene, phenolic products, coumarone-indene resins, and benzene hydrocarbons. In the USSR, benzene takes first place in both importance and tonnage among the primary byproducts of coking and is a source, directly or through intermediate products, of resins used in producing plastics, lacquers, enamels, and other products. Naphthalene, for which coal tar is the principal economic source, is extremely important, particularly in the manufacture of polymers, and also is used to manufacture many other products, including detergents, dye intermediates, insecticides, and wax substitutes. Phenol is used mainly in making synthetic resins and fibers. The coumarone-indene resins are used in producing artificial leather, linoleum, dyes, and varnish. 129/

D. Consumption of Coke

The pattern of consumption of coke in the USSR, based on reported use at iron smelters and estimates for other purposes, is shown in Table 10.* It will be noted that the supply-demand balance includes**

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cubic meters. 120/ Production of natural gas, however, is in a sharply rising trend, amounting to 45.1 billion cubic meters in 1960, 121/ and, according to plan, will reach 150 billion cubic meters in 1965. 122/

* Table 10 follows on p. 35.
** Text continued on p. 38.

Table 10

Estimated Supply-Demand Balance for High-Temperature Coke in the USSR
Selected Years, 1955-65

Thousand Metric Tons

	1955	1958	1959	1960	1965
Supply a/*					
Metallurgical (larger than 40 mm)	39,000	45,534	47,780	50,400	70,700
10 to 40 mm	4,593	5,360	5,620	5,800	10,300
Total (larger than 10 mm) b/	43,593	50,894	53,400	56,200	81,000 c/
Breeze (less than 10 mm)	2,307	2,706	2,800	3,000	5,200
Imports d/	0	0	0	0	0
Total supply	45,900	53,600	56,200	59,200	86,200
Demand					
Smelting iron ore	29,307 e/	31,445 f/	33,111 f/	33,854 g/	48,300 h/
Sintering iron ore i/	2,307	2,706	2,800	3,000	5,200
Iron foundries j/	2,400	3,500	3,750	4,000	5,800
Smelting nonferrous ores k/	318	336	340	344	410
Chemical industry l/	798	844	798	821	1,061
Other m/	9,589	13,030	13,580	15,335	22,729

* Footnotes for Table 10 follow on p. 36.

Table 10

Estimated Supply-Demand Balance for High-Temperature Coke in the USSR
Selected Years, 1955-65
(Continued)

Thousand Metric Tons

	1955	1958	1959	1960	1965
Total	44,719	51,861	54,379	57,354	83,500
Exports	1,181	1,739	1,821	1,846	2,700
Total demand	45,900	53,600	56,200	59,200	86,200

a. Except for the total of sizes exceeding 10 mm, which represents reported output, all other figures for distribution by size are estimates. These estimates are based on the following distribution by size of the total yield of coke at the plants: (1) for 1955-60: larger than 40 mm, 85 percent; 10 to 40 mm, 10 percent; and less than 10 mm, 5 percent, and (2) for 1965: larger than 40 mm, 82 percent; 10 to 40 mm, 12 percent; and less than 10 mm, 6 percent. The reduced percentage of metallurgical sizes in 1965 is based on the expectation that the use of more gas coal will result in weaker coke and more breakage.
b. For sources, see Table 7, p. 30, above.
c. Upper limit of the range of the goal of the Seven Year Plan for 1965 of 76 million to 81 million tons.
d. Excluding coke, reportedly imported from Poland, as follows (in tons): 1955, 345,000; 1958, 630,000; and 1959, 678,000. 130/ This coke was reexported to other countries.
e. 131/
f. 132/
g. 133/
h. Based on production of 70 million tons of pig iron in 1965 and a rate of consumption of coke per ton of pig iron of 690 kilograms.
i. Estimated consumption of breeze.

Table 10

Estimated Supply-Demand Balance for High-Temperature Coke in the USSR
Selected Years, 1955-65
(Continued)

j. Based on US plant practice (where the weight of finished iron castings averages about 62.5 percent of the materials charged at the furnaces and where coke accounts for 17.5 percent of the weight of materials) and on Soviet production of iron castings as follows (in thousand tons): 1955, 6,900; 1958, 10,100; 1959, 10,800; 1960, 11,550; and 1965, 16,300. Estimates include additional coke for heating.
k. See Table 17, Appendix B, p. 66, below.
l. See Table 18, Appendix B, p. 67, below.
m. Most of this coke presumably is used to manufacture producer gas and water gas.

breeze, all of which presumably is utilized in sintering iron ore.* Supplies of coke have been ample in recent years to satisfy all essential requirements and still leave sizable quantities for export.

In 1960 the blast furnaces of the iron and steel works consumed about 34 million tons of coke, or about 60 percent of the total production (excluding breeze) and about two-thirds of the coke of metallurgical grade. Significantly, the rate of coke consumption per ton of pig iron produced declined during the decade 1950-59 from 944 kilograms (kg) to 771 kg and showed a sharp drop in 1960 to only 724 kg. The reduction in the rate of consumption of coke in 1960 resulted mostly from the use of natural gas and oxygen at a considerable number of blast furnaces, although other factors such as higher top pressure and better moisture control also were an influence. The use of natural gas saves from 10 to 15 percent in the quantity of coke required for producing each ton of pig iron. In recent years the rate of consumption of coke at Soviet blast furnaces has been lower than in the US.**

During the Seven Year Plan the USSR expects to reduce the rate of consumption of coke at blast furnaces by 12 percent, 134/ indicating consumption of about 690 kg per ton of pig iron. At this rate, about 48 million tons of coke would be required for production of 70 million tons of pig iron in 1965. If production of pig iron should reach 72.5 million tons in 1965, a possible achievement, blast furnaces may require about 50 million tons of coke. This demand would not strain capabilities.

The foundry industry is another important consumer of coke, which is essential in melting pig iron and scrap for production of castings. It is estimated that Soviet foundries melted nearly 23 million tons of material in 1960 and will melt about 33 million tons in 1965. On the basis of consumption of coke in US plants, where it represents about 17.5 percent of the furnace charge, Soviet requirements of foundry coke amounted to about 4 million tons in 1960 and will increase to about 5.8 million tons in 1965.

It is known that the USSR utilizes coke in smelting ores containing lead, zinc, copper, and nickel in shaft or blast furnaces. The trend, however, is to construct reverberatory furnaces, so that requirements for coke in nonferrous metallurgy may decline. Consumption of coke in production of lead, zinc, and copper is estimated at only 344,000 tons in 1960

* In 1959, production of iron sinter amounted to 56.8 million tons. 135/ The rate of consumption of coke ranges from 4 to 6.8 percent of the total weight of material burned, 136/ indicating that this processing takes about all of the breeze that is available.

** At US plants the rate of consumption of coke per ton of pig iron averaged 785 kg in 1959 and 749 kg in 1960.

and 410,000 tons in 1965. Where coke is used in smelting and refining nickel, the rate of consumption of coke is rather high, amounting to 50 to 55 tons of coke per ton of refined nickel, 137/ but information is not sufficient to permit reliable estimates. All of the coke produced at Noril'sk, about 200,000 tons annually, has been used to smelt local ores containing copper, nickel, and cobalt.

The Soviet chemical industry consumes coke in the manufacture of ammonia and calcium carbide. For these particular uses, it is estimated that requirements amounted to 821,000 tons in 1960 and that the figure will rise to about 1.1 million tons in 1965.

After allowance for the foregoing items of consumption, there remains a large volume of coke that cannot be distributed. Thus about 15 million tons of coke were available in 1960 that probably were used mainly for heating purposes and for gas generation. No information is available as to the disposition of this coke. By 1965 the amount of coke available for purposes that cannot be determined will amount to about 23 million tons. It is believed that a considerable part of this coke will be of metallurgical grade, although transportation and handling results in breakage and thus in a sharp reduction in the quantities that can be used for metallurgical purposes.

E. Costs of Coking Coal and Coke

1. Coking Coal

Coking coals are very expensive in the USSR, especially in the western areas, where the costs of mining are generally more than twice as much as in the eastern fields. In 1957, each ton of raw coking coal mined in the Donets Basin cost, on the average, 133 rubles* per ton, which was 15 rubles more than in the Pechora Basin. In contrast, the cost of Karaganda and Kuznetsk coking coals averaged about 63 to 64 rubles per ton. 138/ The upward trend in the costs of mining coking coals during 1955-57 is shown in Table 11.** Further increases in costs occurred in 1958-59 as a consequence of the change to shorter working hours and to higher rates of pay. In the Donets Basin, for example, the costs of mining coking coals increased 7.9 percent in 1959. 139/ In 1960, however, costs declined from the 1959 level as a result of improvements in labor productivity but were still higher than in 1957. At the official rate of exchange that existed before 1 January 1961 (4 rubles to US $1), it can be seen that the cost of producing the cheaper coals would exceed

* Except for data on foreign trade, ruble values in this report are given in old rubles (ruble values in use before the Soviet currency reform of 1961) and may be converted to US dollars at the rate of exchange of 4 rubles to US $1. This rate does not necessarily reflect the value of the ruble in terms of the dollar.

** Table 11 follows on p. 40.

$15 per ton and that Donets coals would cost $33 per ton. Such high costs are to be compared with only $4 to $7 per ton of cleaned coal in the US, where quality generally is much superior to the Soviet product. The poor quality of Soviet coals results in even higher costs because of the large losses in cleaning. Thus cleaning can add from 5 to 50 rubles per ton to the mine costs.

Table 11

Average Costs of Producing Coal in the Major Basins of the USSR a/
1955-57

Basin	Current Rubles per Metric Ton 1955	1956	1957
Donets			
All coal	90.96	96.58	110.66
Bituminous coal	105.66	114.58	127.89
Coal used for coking	109.00	119.70	133.00
Kuznetsk			
All coal	57.55	56.29	56.62
Coal from deep mines	61.07	60.75	60.78
Coal from deep mines used for coking	64.00	63.80	63.85
Karaganda			
All coal	44.54	42.34	52.68
Bituminous coal from deep mines	58.63	59.41	59.85
Coal used for coking	61.56	62.41	62.85
Pechora (Vorkuta only)			
All coal	93.93	106.00	112.69
Coal used for coking	98.08	111.64	118.00

a. 140/

Insofar as can be determined, the mine prices of coking coals have remained substantially unchanged since the present price schedule became effective on 1 July 1955. Because of the high costs of mining, no turnover taxes are applied to coal. Prices, at the time they were established, were intended to reflect the current costs of production with an allowance for a small margin of profit. The trend to higher costs results in substantial losses on Donets and Pechora coals and possibly minor losses on Karaganda coals, but prices for Kuznetsk coals permit some profit at current costs. Mine prices for various types of coking coal listed in the price schedule of 1 July 1955 were as follows 141/:

	Rubles per Ton			
Type of Coal	Donets Basin	Pechora Basin	Karaganda Basin	Kuznetsk Basin
Raw coal				
K	111.00			78.30
K_2				69.00
PZh	110.40	86.50	66.20	78.30
PS (OS)	112.00		60.20	62.00
Concentrates				
K	157.80			95.00
K_2				83.00
PZh	152.00	128.80	118.00	90.80
PS (OS)	158.80		118.00	83.00

As indicated in Table 12,* the delivered price of coking coal averaged 136.5 rubles per ton at all Soviet coke plants in 1958 and 118.7 rubles per ton at eastern plants. 142/ The average cost at western plants is estimated at approximately 148 rubles per ton, on the assumption that these plants utilized about 60 percent of the coking coal. These data reflect higher prices for a large portion of the coal cleaned at the mines as well as lower prices charged for coals that are not classified as coking coals.

According to the Seven Year Plan, the cost of producing coking coals in 1965 will be reduced in comparison with 1958 by about 13 percent in the Donets Basin and 3 percent in the Kuznetsk and Pechora Basins but will rise slightly at the Karaganda mines. In 1965 the average costs of

* Table 12 follows on p. 42.

raw (run-of-mine) coal at the mine and of concentrates at the cleaning plants in the important coal basins are expected to be as follows 143/:

Basin	Rubles per Ton	
	Raw Coal	Concentrates
Donets	116.00	153.30
Kuznetsk	62.00	84.60
Karaganda	63.00	97.50
Pechora (Vorkuta only)	114.00	157.30

Table 12

Average Delivered Prices of Coal to Coke Plants in the USSR a/ 1954-55 and 1958

	Current Rubles per Metric Ton		
	1954	1955	1958
Delivered cost to all plants			
List price at mines	121.5	122.9	120.3
Freight	13.2	12.8	12.8
Other costs	7.1	6.0	3.4
Delivered price	141.8	141.7	136.5
Delivered cost to eastern plants b/			
List price at mines	89.0	87.5	86.4
Freight	27.8	29.2	32.3
Other costs	0	0	0
Delivered price	116.8	116.7	118.7

a. 144/
b. Including the Urals.

2. Coke

In the Dnepr area of the Ukraine the cost of producing coke ranged from 199 to 210 rubles per ton in 1959 145/ and may have been as low as 180 rubles per ton at some plants in the Donets Basin because of

savings in freight charges. The cost of converting coal to coke is about 27 rubles per ton. 146/ At the Cherepovets plant in Region Ib, coke can be produced for 209 rubles per ton on the basis of Kuznetsk coals, hauled 3,487 km (transport costs are 55 rubles per ton of coal), whereas the coke costs about 268 rubles per ton using Donets coals and 293 rubles with Pechora coals. 147/ In the Georgian SSR (Region V) the Rustavi plant produces coke for about 310 rubles per ton, utilizing equal parts of Donets coals and local coals, but the quality is very poor (18.5 percent ash). If the coke were produced solely from Donets coals, the cost would be about 280 rubles per ton. 148/ The most expensive coke in the USSR probably is made at the Leningrad Gas Works (Region Ia).

In the Urals the cost of making coke probably is a little less, on the average, than in the Ukraine and varies according to the location of the plant as well as the source and quality of the coal. Kuznetsk coals are a little cheaper than Karaganda coals at the Nizhniy Tagil and Chelyabinsk coke plants, where the cost of the coke is between 180 and 195 rubles per ton. At Magnitogorsk the cost is in the range of 185 to 200 rubles per ton. 149/ In West Siberia, coke is produced for about 145 rubles per ton. 150/ The cost of coke can be reduced in accordance with allocation of a part of the expenses to the byproducts.

In production of pig iron, coke accounts for 40 to 70 percent of the cost at western plants, about 70 percent in the Urals, and about 26 percent in West Siberia. 151/

At an approximate average cost of producing oven coke in the USSR of 185 rubles per ton in 1960, the total value of finished coke amounted to about 10.4 billion rubles. When byproducts are considered, it is probable that the total value of output of the coke-chemical industry exceeded 13 billion rubles.

F. Foreign Trade

Until recent years the USSR was a net importer of both coal and coke, all of which came from Poland. According to official Soviet statistics,* Poland supplied 4.52 million tons of coal and 0.66 million tons of coke in 1960 compared with 4.12 million tons of coal and 0.68 million tons of coke in 1959.** However, most, if not all, of this coal, which was not of coking quality, and probably much of the coke were reexported, mainly to East Germany. It is estimated that the total exports of coal from Soviet mines amounted to 6.9 million tons

* Soviet statistics include reexports of commodities, which in many cases never enter the USSR but are included in export and import data.
** The USSR also imports about 200,000 tons of coal annually from Communist China, but it is not for coking purposes. 152/

in 1959 and about 7.7 million tons in 1960. The foregoing figures include approximately 1.8 million tons of anthracite each year, the bulk of which was supplied to Western Europe from Donets mines. The remaining coal shipments consisted of bituminous coal, including coking coal. Data on exports of anthracite and bituminous coal, by country, during 1955 and 1958-60 are given in Table 13.*

Of approximately 6 million tons of bituminous coal exported by the USSR in 1960, it is estimated that 3.2 million tons consisted of types that were suitable for coking purposes. All of this coal, with the exception of 542,000 tons supplied to Japan from eastern mines, came from the Donets Basin. Available evidence indicates that exports of coking coal probably will reach 4.3 million tons in 1965. Shipments of coke amounted to 1.85 million tons in 1960, and were slightly higher than in 1959. Future deliveries, however, probably will increase considerably. By 1965 it is expected that the USSR will be exporting at least 2.7 million tons of coke and will have the capability to supply much greater quantities. The volume of exports of coke to Western Europe will depend largely on Soviet willingness to make prices sufficiently attractive to compete with those of other sellers. Data on approximate exports of coking coal and coke in 1959-60 and estimates for 1965 are given in Table 14.**

1. Satellite Countries

Exports of coking coal to the Satellite countries are estimated to have been 1.36 million tons in 1960 in comparison with 0.79 million tons in 1959, an increase of about 70 percent. Coking coal is shipped to East Germany, Hungary, Poland, and Rumania, whereas coke is furnished to Bulgaria, East Germany, Hungary, and Rumania. Poland has received most of the coking coal. The only countries that are independent of Soviet supplies of both coking coal and coke are Albania and Czechoslovakia. Exports of coke to the Satellite countries amounted to 1.47 million tons in 1960, slightly higher than in 1959. A reduction in shipments to Bulgaria tended to offset most of the increases in exports of coke to East Germany, Hungary, and Rumania.

On the basis of plans for production of coke and pig iron as well as on the basis of capabilities of supply in individual countries, it is estimated that Soviet exports to the Satellite countries in 1965 will be about 1.3 million tons of coking coal and 1.7 million tons of coke. Additional quantities of both commodities could be made available to these countries, if necessary. (For a discussion of the supply and demand for coking coal and coke in individual countries, see III, below.)***

* Table 13 follows on p. 45.
** Table 14 follows on p. 47.
*** Text continued on p. 50.

Table 13

Exports of Coal from the USSR
1955 and 1958-60

Thousand Metric Tons

Recipient	1955 a/*		1958 b/		1959 b/		1960 c/	
	Anthracite	Bituminous	Anthracite	Bituminous	Anthracite	Bituminous	Anthracite	Bituminous
Non-Bloc Countries								
Western Europe								
Austria	5	0	0	292	0	513	0	731
Belgium	107	8	69	0	44	0	20	0
Denmark	0	Negl.	0	16	0	193	0	413
Finland	149	61	264	525	172	557	241	498
France	549	0	703	0	719	0	795	0
West Germany	0	85	0	124	0	171	0	66
Greece	2	33	4	20	1	12	7	44
Iceland	1	7	1	0	2	0	1	0
Italy	209	2	253	5	331	34	370	105
Netherlands	125	0	39	2	57	6	22	10
Sweden	19	87	24	43	21	82	36	105
Switzerland	12	0	0	0	0	0	6	0
Yugoslavia	70	183	91	634	93	808	132	795
Subtotal	1,248	466	1,448	1,661	1,440	2,376	1,630	2,767
Far East								
Japan	0	67	0	437	13	362	31	511
Middle East								
Pakistan	0	Negl.	0	50	0	0	0	0
Egypt	0	4	0	4	0	6	0	24
Total	1,248	537	1,448	2,152	1,453	2,744	1,661	3,302

* Footnotes for Table 13 follow on p. 46.

Table 13

Exports of Coal from the USSR
1955 and 1958-60
(Continued)

Thousand Metric Tons

Recipient	1955 a/		1958 b/		1959 b/		1960 c/	
	Anthracite	Bituminous	Anthracite	Bituminous	Anthracite	Bituminous	Anthracite	Bituminous
Bloc Countries								
European Satellites								
Albania	0	0	0	0	0	0	0	0
Bulgaria	0	0	0	0	0	0	0	0
Czechoslovakia	15	0	3	1,007	7	1,029	8	1,046
East Germany	150	39	422	850 d/	356	570 d/	102	445 d/
Hungary	1	0	1	89	1	66	0	204
Poland	19	0	14	376	17	598	20	774
Rumania	0	0	0	0	0	0	0	133
Subtotal	185	39	440	2,322	381	2,263	130	2,602
Far East								
Mongolia	0	0	0	77	0	74	0	53
Total	185	39	440	2,399	381	2,337	130	2,655
Grand Total	1,433	576	1,888	4,551	1,834	5,081	1,791	5,957

a. 153/
b. 154/
c. 155/
d. Estimate based on official Soviet figures, which include Polish coal.

Table 14

Estimated Exports of Coking Coal and Coke from the USSR
1959-60 and 1965

Thousand Metric Tons

Recipient	Coking Coal			Coke		
	1959 a/*	1960 b/	1965 c/	1959 d/	1960 b/	1965 c/
Non-Bloc Countries						
Western Europe						
Austria	513	731	900 e/	54	64	500 e/
Denmark	0	0	0	103	76	N.A. f/
Finland	0	0	0	120	99	N.A. f/
Italy	34	50	100	0	0	0
Sweden	0	0	0	102	125	N.A. f/
Yugoslavia	808	795	1,000	0	0	0
Other	0	0	0	2	10	N.A.
Subtotal	1,355	1,576	2,000	381	374	1,000 f/
Far East						
Japan	345	250 g/	1,000	0	0	0
Total	1,700	1,826	3,000	381	374	1,000

* Footnotes for Table 14 follow on p. 48.

Table 14

Estimated Exports of Coking Coal and Coke from the USSR
1959-60 and 1965
(Continued)

Thousand Metric Tons

Recipient	Coking Coal			Coke		
	1959 a/	1960 b/	1965 c/	1959 d/	1960 b/	1965 c/
Bloc Countries						
European Satellites						
Albania	0	0	0	0	0	0
Bulgaria	0	0	0	141	103	200
Czechoslovakia	0	0	0	0	0	0
East Germany	125 h/	250	200	316 i/	368	200
Hungary	66	204	160	564	594	500
Poland	598	774	400	0	0	0
Rumania	0	133	500	419	407	800
Total	789	1,361	1,260	1,440	1,472	1,700
Grand Total	2,489	3,187	4,260	1,821	1,846	2,700

50X1

c. Figures for European Satellites are based on calculated requirements, indigenous supplies, and probable imports from other countries.

Table 14

Estimated Exports of Coking Coal and Coke from the USSR
1959-60 and 1965
(Continued)

d. 158/
e. A trade treaty signed in October 1960 calls for delivery of 900,000 tons of coking coal and 500,000 tons of coke annually through 1965. 159/
f. Increased shipments are believed to be probable, and the total shipments to Western Europe should be at least 1 million tons.
g. The total imports of anthracite and bituminous amounted to 263,004 tons. 160/
h. The USSR reported exports of 4.7 million tons to East Germany in 1959, but this amount is practically all Polish coal. In 1958 the USSR reported imports of 3.6 million tons from Poland, although only 53,000 tons actually were received.
i. The USSR reported exports of 946,000 tons to East Germany in 1959, but it is estimated that two-thirds of this coke came from Poland.

2. Western Europe

In 1960 the USSR sold coal in 13 countries of Western Europe, although coking coal was supplied only to Yugoslavia, Austria, and Italy. Coke was shipped mainly to Austria, Denmark, Finland, and Sweden, with minor quantities to Greece and Iceland. Of approximately 4.4 million tons of coal sent to Western Europe in 1960, it is estimated that coking coal totaled only about 1.6 million tons, including 0.8 million tons to Yugoslavia, 0.7 million tons to Austria, and a minor quantity to Italy. These exports were about one-quarter of a million tons higher than in 1959, and practically all of the increment went to Austria, which received 513,000 tons in the previous year. Shipments of coke were relatively small, amounting to 381,000 tons in 1959 and 374,00 tons in 1960.

Significantly, none of the countries in Western Europe is especially dependent on Soviet supplies of coking coal or coke. There apparently are some advantages for Yugoslavia and Austria to use Soviet coal because of barter arrangements. The same condition probably applies to coke in some other countries, notably Finland, which now obtains a substantial part of its coke from the USSR.

It is impossible to make any reliable forecasts of Soviet exports to Western Europe, although somewhat larger shipments of coking coal and coke may be expected. The USSR should be in a better position to supply coke, especially in smaller sizes than before, but the more desirable types of coking coal that Western countries want (such as types K and PS) probably will not be generally available for export, because of indigenous requirements in the USSR.

3. Far East

The USSR does not export coke to countries in the Far East, and shipments of coking coal are limited to Japan. Because of its small resources of coking coal, Japan has been forced to increase the total imports of such coals in order to satisfy the expanding needs of its iron and steel industry. Imports of coking coal have risen from 3.9 million tons in 1958 to more than 7.0 million tons in 1960.* During 1959 the iron and steel industry required about 8.9 million tons of coking quality coal, of which approximately 4.5 million tons was imported. According to Japanese estimates, the iron and steel industry of Japan will need from 14 million to 16 million tons in 1965. Of that amount it is estimated

* In 1960, Japan imported almost 8.3 million tons of anthracite and bituminous coals, 161/ of which probably more than 80 percent was coking coal.

that imports must supply between 9 million and 11 million tons by 1965, as indigenous supplies probably will not exceed 5 million tons.* 162/

The US has been the major source of coking coal for Japan, accounting for nearly 80 percent of the total amount imported by that country during 1958 and 1959 and at least 65 percent in 1960. The US coal supplied, which is mined in southern West Virginia and shipped from Hampton Roads, is of exceptionally high quality and costs around $18.50 to $19.00 per ton at Japanese ports. The high cost is an inducement for the Japanese to seek cheaper coal, and they are making efforts to develop other sources of supply closer to Japan.

Because of the inferior quality of Soviet coals supplied from Sakhalin Island and the Kuznetsk Basin and the lack of adequate docking facilities at Soviet ports, Soviet offers to supply more coking coal to Japan at attractive prices have met with considerable resistance. Shipments from the USSR amounted to only 319,000 tons in 1958 and 344,835 tons in 1959. 164/ Shipments in 1960 declined to about 250,000 tons. 165/ The USSR has agreed to build a second port to supplement the inadequate facilities at Nakhodka and, presumably, has furnished some guarantees of quality, particularly with regard to the ash content and friability of Kuznetsk coals. A new longer term contract signed in November 1960 calls for shipments of 1.5 million tons of Kuznetsk coals in addition to 690,000 tons of Sakhalin coal during 1960-62. 166/ It is not known, however, whether all of the tonnage consists of coking coal.** Prices were set at $12.00 to $12.25 per ton for Kuznetsk coals 167/ and from $8.75 to $10.50 per ton f.o.b. for Sakhalin coals. With freight costs of about $2.25 per ton, the most expensive Soviet coal at Japanese ports probably is not more than $15.00 per ton, which probably is less than the price of any other foreign coals at the present time.

The USSR has attempted to interest the Japanese in trade that would promote development of the tremendous deposits of iron ore near Chulman in East Siberia. These deposits are close to large deposits of coal that Soviet technologists claim have superior coking qualities. 168/ Development of these deposits is underway, and when about 400 km of railroad construction are added to the main line of the Trans-Siberian Railroad, the USSR should be in an even more competitive position with respect to the Japanese market for iron ore and coking coal. Construction

* Production of coking coal amounted to only 656,000 tons in 1958 and 630,000 tons in 1959, but large quantities of semicoking coal are mined and used in coke ovens. Output of these types amounted to nearly 9.6 million tons in 1959. 163/

** Minor quantities of Soviet coals of other types were imported in 1958 and 1959. These noncoking coals represented more than half the total in 1960.

of this railroad is under consideration. Even if this new source of iron ore and coal is not ready by 1965, Soviet exports of coal to Japan may rise to at least 1 million tons in that year. Soviet offers to buy much greater quantities of Japanese products, especially steel, represent a strong inducement for the Japanese to increase their trade with the USSR.

III. Supply of and Demand for Coking Coal and Coke in the European Satellites

A. Czechoslovakia

Czechoslovakia, the only country among the European Satellites that is self-sufficient in supplies of coal for coking purposes, has ample reserves, as indicated by data in Tables 15* and 16.** The Ostrava-Karvina Basin accounted for more than 80 percent 169/ of the total output of about 26.4 million tons*** of bituminous coal mined in Czechoslovakia in 1960, 170/ although only about 3.7 million tons were of types classified as premium coking coals.† Because mining is handicapped by unfavorable geological conditions -- resulting in low labor productivity, restricted output, and high costs -- the supply of bituminous coals has not been adequate to meet both the country's domestic needs and those for exports. To make some coking coal available for export to other Satellite countries, other coals have been imported from Poland and the USSR for steam purposes.

Imports of bituminous coal totaled 2.57 million tons in 1958 and 2.36 million tons in 1959. 172/ Shipments to foreign countries amounted to 1.5 million tons in 1958 and 1.6 million tons in 1959, including about 1 million tons of coking coal each year. Between 70 and 80 percent of these exports went to East Germany, Hungary, and Rumania. Except for minor deliveries to West Germany, the balance was shipped to Austria. 173/ In 1960 the supply available for export probably exceeded 2 million tons, including 1.6 million tons of coking coal.

Of the 21.8 million tons of coal mined in the Ostrava-Karvina Basin in 1960, 174/ more than 50 percent was required to produce about 7.9 million tons of oven coke.†† Possibly as much as 6.8 million tons†††

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* Table 15 follows on p. 53.

** Table 16 follows on p. 57.

*** Data on Czechoslovak production are in net tons -- that is, after elimination of reject material at the cleaning plants.

† Estimate based on data in source 171/.

†† Minor quantities of coal from the Kladno Basin also are used for coking purposes. Oven coke is produced at 10 plants, including 9 in the Ostrava-Karvina area. 175/

††† Text continued on p. 57.

Table 15

Estimated Availability of Coking Coal and Oven Coke in the Soviet Bloc
1959-60 and 1965

Thousand Metric Tons

	Albania	Bulgaria	Czechoslovakia	East Germany	Hungary	Poland	Rumania	USSR	Total
					1959				
Coking Coal									
Total production a/*	0	0	12,000 b/	300 c/	350 d/	18,900 e/	700 f/	78,000 g/	110,250
Production (premium quality) h/	0	0	3,570 i/	300 c/	0 d/	1,970 j/	0 k/	66,000 l/	71,840
Consumption at oven-coke plants m/	0	0	10,350	1,335	563	13,724	870	74,200	101,042
Imports (metallurgical) n/	0	0	0	1,450 o/	216	800 p/	192	0	2,658
Exports (metallurgical) n/	0	0	1,019 q/	0	0	0 r/	0	2,489 s/	3,508
Oven Coke									
Production (excluding breeze)	0	0	7,231 t/	935	394	10,579 u/	609 v/	53,400 w/	73,148
Production (metallurgical) x/	0	0	6,287 y/	745 z/	362 aa/	7,259 bb/	400 cc/	47,780 dd/	62,833
Smelting iron ore ee/	0	250	4,340	2,560	1,270	4,040	1,060	33,111 ff/	46,631
Imports (metallurgical)	11 gg/	327	0	2,131 hh/	1,018 aa/	0	700 ii/	0	4,187
Exports (metallurgical)	0	0	982 jj/	0	0	1,647 kk/	0	1,821 s/	4,450
					1960				
Coking Coal									
Total production a/	0	0	13,000 b/	300 c/	450 d/	18,000 ll/	875	83,000 g/	115,625
Production (premium quality) h/	0	0	3,675 i/	300 c/	0 d/	2,300 j/	0 k/	70,500 l/	76,775
Consumption at oven-coke plants m/	0	0	11,200	1,350	785	14,600	1,175	80,000	109,110
Imports (metallurgical) n/	0	0	0	1,300	350	800 p/	325	0	2,775
Exports (metallurgical) n/	0	0	1,600	0	0	0 r/	0	3,187	4,787
Oven Coke									
Production (excluding breeze)	0	0	7,870 mm/	945	560	10,970	820 nn/	56,200 oo/	77,365
Production (metallurgical) x/	0	0	6,780 mm/	750 pp/	499 aa/	7,712 bb/	560 cc/	50,400 dd/	67,701
Smelting iron ore ee/	0	265	4,835	2,595	1,310	4,130	1,215	33,854 ff/	48,204
Imports (metallurgical) qq/	12	296	0	2,250	971 aa/	0	656	0	4,185
Exports (metallurgical) qq/	0	0	950	0	0	1,655	0	1,846	4,451

* Footnotes for Table 15 follow on p. 54.

Table 15

Estimated Availability of Coking Coal and Oven Coke in the Soviet Bloc
1959-60 and 1965
(Continued)

Thousand Metric Tons

	Albania	Bulgaria	Czechoslovakia	East Germany	Hungary	Poland	Rumania	USSR	Total
	1965								
Coking Coal									
Total production a/	0	620 rr/	18,500 b/	300 c/	800 d/	23,680 ss/	1,500 tt/	122,000 g/	167,400
Production (premium quality) b/	0	620 rr/	5,425 i/	300 c/	0 d/	4,500 j/	0 k/	98,000 l/	108,845
Consumption at oven-coke plants m/	0	1,000 rr/	16,100	1,600	1,060	18,350	2,285	117,000	157,395
Imports (metallurgical) gg/	0	380 rr/	0	1,300	360	600	800 tt/	0	3,440
Exports (metallurgical) gg/	0	0	1,700	0	0	0 r/	0	4,260	5,960
Oven Coke									
Production (excluding breeze)	0	730 uu/	11,270 vv/	1,100 ww/	800 xx/	13,100 yy/	1,600 zz/	81,000 aaa/	109,600
Production (metallurgical) x/	0	550 uu/	9,720 vv/	820 ww/	640 xx/	9,750	1,040	70,700	93,220
Smelting iron ore ee/	0	1,380	5,500	2,580	1,775	5,540	2,200	48,300	67,275
Imports (metallurgical) gg/	15	830	0	2,200	1,300	0	1,160 tt/	0	5,505
Exports (metallurgical) gg/	0	0	2,000 to 2,500	0	0	2,000 to 2,500	0	2,000 to 4,000	6,000 to 9,000

a. The figures represent an approximation of production of prepared coal and of such raw coal as is suitable for charging at the ovens. Furthermore, they include for all countries, except East Germany, large quantities of coals, especially high-volatile gas coals, that ordinarily are not classified as coking coals.

c. Approximately 10 percent of the hard coal produced. 177/
d. 178/
e. 179/
f. Based on requirements. Production was reported to have been 465,000 tons in 1957. 180/

h. Strongly caking coals but excluding gas coals used in blends. These coals are represented by types 35 to 38 (coking and low-volatile coals) in Poland and Czechoslovakia and by types K, PZh, and OS in the USSR.
i. 182/
j. 183/
k. Minor quantities have strong caking characteristics but contain excessive quantities of ash and sulfur. Raw coal contains 30 to 40 percent ash. 184/

Table 15

Estimated Availability of Coking Coal and Oven Coke in the Soviet Bloc
1959-60 and 1965
(Continued)

l. [redacted] Approximately 85 percent of the coal produced for coking consisted of types K, PZh, and PS in 1959-60, but these types will account for only about 80 percent in 1965. 50X1

m. Based on production of oven coke and yields of about 70 percent, excluding breeze, in the Satellites and about 72 percent in the USSR.

n. Based on numerous sources for published trade statistics and information as to the type of coal involved in the trade. The figures are approximations. East Germany and Poland have imported coking coal from the Free World, amounting to 1.4 million tons in 1959 and about 650,000 tons in 1960.

o. Estimate of quantity used for oven coke. The plan called for imports of 2.96 million tons of coking coal, 186/ about 50 percent of which would be used in gas works.

p. 187/

q. 188/

r. Excluding gas coals, some of which are used to produce oven coke and gas coke in other countries.

[redacted] 50X1

t. Production of hard coal coke, including gas coke, amounted to 7.9 million tons. 190/

u. 191/

v. 192/

w. 193/

x. Sizes that exceed 40 millimeters.

y. 194/

z. Reported as 995,000 metric tons 195/ but including an estimated total of 250,000 tons of brown coal coke and some gas coke.

aa. 196/. Production in 1959-60 evidently includes some gas coke.

bb. 197/

cc. Estimate. The yield is low.

dd. Estimate. The yield is about 85 percent of total coke, including breeze.

ee. Based on production of pig iron and consumption of oven coke as follows:

	Production of Pig Iron (Thousand Tons)			Consumption of Oven Coke (Larger Than 40 mm) (Tons of Coke per Ton of Pig Iron)		
	1959	1960	1965	1959	1960	1965
Bulgaria	177	189	1,400	1.41	1.40	0.99
Czechoslovakia	4,245	4,695	7,650	1.02	1.03	0.72
East Germany	1,898	1,995	2,150	1.35	1.30	1.20
Hungary	1,104	1,249	1,775	1.15	1.05	1.00
Poland	4,080	4,260	6,440	0.99	0.97	0.86
Rumania	846	1,014	2,000	1.25	1.20	1.10
USSR	42,986	46,800	70,000	0.77	0.72	0.69

Because of rounding of data on consumption of oven coke, data for smeltering iron ore may differ slightly from calculations based on these figures.

Table 15

Estimated Availability of Coking Coal and Oven Coke in the Soviet Bloc
1959-60 and 1965
(Continued)

ff. 198/
gg. Received from Poland 199/ but possibly not of metallurgical grade.
hh. Plan. Actual imports for 9 months (January-September) were about 1.6 million tons. 200/
ii. Based on 419,000 tons from the USSR, 111,700 tons from Poland, and the balance from Czechoslovakia. 201/
jj. 202/
kk. Total exports of coke were 2,068,000 tons. 203/
ll. 204/
mm. Plan. 205/ Total hard coal coke, including gas coke, was about 8.4 million tons.
nn. 206/
oo. 207/
pp. Plan. 208/
qq. Estimated, unless otherwise indicated.
rr. Plan. 209/
ss. Plan. 210/
tt. Based on requirements and indicated imports. During 1961-65 the USSR will supply 950,000 tons of coking coal and 2.8 million tons of coke. 211/
In order to supply the cokeries with 1.5 million tons of cleaned coals from indigenous sources in 1965, it will be necessary to process about 3.7 million tons of raw coals because the yield of concentrates is only about 40 percent. 212/
uu. [redacted] the total yield of coke will be 78 percent of the charge, and the yield of metallurgical coke will be 707,000 tons. These figures have been adjusted for the breeze and sizes less than 40 millimeters. 50X1
vv. 214/
ww. [redacted] The new battery at the August Bebel Plant will have capacity of 370,000 tons (70 percent metallurgical) and will replace the old battery of ovens. 50X1
xx. On the basis of the information of a 70-percent metallurgical yield, the replaced new battery at Stalinvaros will have a maximum capacity of 260,000 tons.
yy. 216/
zz. 217/
aaa. Upper limit of the range of the goal of the Seven Year Plan for 1965 of 76 million to 81 million tons.

Table 16

Reserves of Bituminous Coal and Coking Coal in the European Satellites a/

Million Metric Tons

Country	Bituminous Coal	Coking Coal	
		Preminum	Gas-Coking
Albania	N.A.	0	b/
Bulgaria	43	N.A. c/	N.A.
Czechoslovakia	6,150 d/	2,250	2,050
East Germany	20 e/	N.A.	2
Hungary	250 f/	N.A. g/	50
Poland	18,000 h/	522 i/	846 i/
Rumania	150 j/	N.A.	N.A.

a. It has been reported that Czechoslovakia and Poland have about 99 percent of the reserves of coking coal. Presumably the statement refers to the premium grades.
b. Small, if any.
c. Minor reserves of low-volatile coals occur in the Balkan Basin, but no high-volatile, strongly caking coals, such as are required for blending, are present.
d. Recoverable. Possible geological reserves total 11 billion tons in the Ostrava-Karvina Basin. 218/
e. Zwickau and Lugau-Oelsnitz Basins. Only 10 percent of these reserves consists of coals that are suitable for coking. 219/
f. 220/
g. Minor quantities, high in ash and sulfur, that are included in estimate for gas-coking coals.
h. Recoverable. Possible geological reserves total 76 billion tons. 221/
i. It is estimated that 2.9 percent of the reserves are in premium grades, and that 4.7 percent are of gas-coking coals. 222/
j. Estimate for the Jiu Valley. The quality is very poor.

of the coke produced in 1960 could have been classified as metallurgical grade (larger than 40 mm), of which an estimated total of 4.8 million tons was used in domestic blast furnaces. The remainder, about 2 million tons, was available for other domestic consumers, mainly iron foundries, and for export. The bulk of the oven coke exported in 1960, estimated at 1.4 million tons, probably was of metallurgical grade. During 1955-59, exports of coke ranged from 1.05 million tons to 1.25 million tons annually, more than 90 percent of which was furnished to Bulgaria, East

Germany, Hungary, and Rumania. The remainder, usually less than 100,000 tons per year, was shipped to Austria, West Germany, and Sweden. 223/

In 1965, oven coke plants in Czechoslovakia will require about 16 million tons of cleaned coking coal to produce 11.3 million tons of coke. 224/ Hence about one-half of the net output of bituminous coal, which is planned to reach 31.4 million tons* in 1965, 226/ will be used for the domestic manufacture of oven coke. The Ostrava-Karvina Basin will account for all of the increase and 85 percent of the total production of bituminous coal in 1965. 227/ At the Czechoslovak coke plants, at least two-thirds of the coal used in the blends consists of gas-coking and gas coals.

For production of about 7.7 million tons of pig iron in 1965, 228/ it is estimated that only about 5.5 million tons of metallurgical coke will be needed, provided that the rate of consumption of coke can be reduced from an average of 1.03 tons of coke per ton of pig iron, the rate in 1960, to 0.72 ton in 1965 as planned. 229/ It is estimated that the available supply of coke of metallurgical grade may amount to approximately 10 million tons, 230/ leaving a large balance for use in domestic foundries and for export. It is believed that at least 2 million tons and possibly more than 2.5 million tons of metallurgical coke should be available for export in 1965.

B. Poland

In spite of the fact that Poland has huge reserves of bituminous coals and produced 104.4 million tons in 1960,** 232/ only 2.9 percent of the reserves and about 2 percent of the output of bituminous coals are classified as coking coals.*** 234/ These coking coals of good

* Gross tonnage was set at 35.5 million tons, 225/ but more than 4 million tons will be eliminated in preparation. The net production of 31.4 million tons represents an increase of 31 percent in comparison with the net output of bituminous coal in 1958. The 1965 Plan, however, calls for production of the prime types of coking coal to increase 56 percent during 1959-65, or to an estimated total of 5.5 million tons. Production of gas-coking coals will increase substantially during the same period, and the quantity available in 1965 will exceed 13 million tons.

** Reserves in 1957 were estimated at 76 billion tons to a depth of 1,000 meters and comprised about one-third of European reserves, exclusive of Soviet reserves. Approximately 80 percent of the Polish reserves of bituminous coals and 83 percent of the output consist of long-flame coals that cannot be used to make oven coke. 231/

*** These coals consist of types 35 to 38, according to the Polish system of classification. Of 36 mines providing coal for use in coking in 1957, only one mine furnished type 35, which is the best quality. Lower volatile coals (types 36 to 38) were produced at three mines. 233/.

quality constitute only about 15 percent of the blends used at Polish coke plants, and the country actually has to import some of these coals. The necessity of using high proportions of gas-coking coals (type 34) and gas coals (type 33), now constituting about 40 percent and 45 percent, respectively, in the blends, results in a weak coke and a low yield of metallurgical grades, or of the sizes larger than 40 mm. 235/

In 1960, production of coals (coking, gas-coking, and gas coals) that could be used to manufacutre oven coke amounted to approximately 18 million tons, including only about 2.3 million tons that are classified as of prime coking quality. 236/ These supplies were augmented by imports of good coking coals from non-Bloc countries and the USSR -- needed for blending -- which have ranged from 0.75 million to 1 million tons annually. On the other hand, Poland exports 16 million to 17 million tons of bituminous coal annually, although none is of the superior types for coking purposes.

Out of a total of nearly 11 million tons of oven coke produced in 1960 at 21 plants in Poland, only 7.7 million tons could be regarded as satisfactory for use in blast furnaces. In 1965, production of oven coke in Poland is scheduled to reach 13.1 million tons, 237/ possibly 9.8 million tons of which will be of metallurgical grade. The Polish surplus of coke, as indicated by exports, has ranged from about 2.0 million tons to 2.3 million tons annually since 1955. Shipments to non-Bloc countries have been about 200,000 tons annually. During 1959-60 a total of about 1.7 million tons of coke was exported each year to the European Satellites, although there were no shipments to Czechoslovakia. East Germany alone received about three-fourths of this coke, including quantities charged to Soviet account. By 1965 it is expected that Poland will be able to furnish between 2 million and 2.5 million tons to the European Satellites, including 1.4 million tons to East Germany. It is estimated that domestic use for blast furnaces will require only about 5.5 million tons. The apparent surplus, however, may be substantially reduced if the consumption rates at blast furnaces fail to decline as expected and if foundry requirements expand.

C. East Germany

East Germany suffers from an acute shortage of indigenous supplies of coking coal. The proved reserves of bituminous coals in the Zwickau and Lugau-Oelsnitz Basins are estimated at less than 20 million tons, of which only 10 percent is considered to be of metallurgical coking quality. 238/ Mining conditions are extremely difficult, and production is held to a fairly constant level of between 2.7 million and 3 million tons annually. 239/ Most of this coal possibly is consumed at approximately 200 gas works that produce gas and gas coke. 240/ Output of gas coke in 1960 is estimated at 2.8 million tons, possibly 0.4 million tons of which

could be used in blast furnaces. Metallurgical coke is produced at four plants, which include two gas works -- Lichtenburg (East Berlin) and Magdeburg. These gas works utilize, for the most part, coking coals that have to be imported. Only about 300,000 tons of native coals are available each year to make oven coke, which is produced at the August Bebel and Karl Marx Plants, near Zwickau. Both plants are approximately the same size, and their combined capacity is about 350,000 tons of coke of metallurgical grade annually. 241/

In order to satisfy its requirements, East Germany is forced to import large quantities of coking coal for the gas works as well as coke for metallurgical needs. There is some evidence, however, that imports of coking coal may have declined from about 1.5 million tons in 1959 to about 1.3 million tons in 1960. A shift to greater use of brown coal at the gas works has started and possibly will serve to hold imports to the 1960 estimate for some years. Significantly, about two-thirds (970,000 tons) of the imports of coking coal in 1959 came from West Germany, 242/ but these shipments probably fell sharply in 1960. Czechoslovakia became the major source of supply in 1960 and may furnish about 1 million tons in 1965. Imports from the USSR are estimated at 250,000 tons in 1960 and 200,000 tons in 1965.

Production of pig iron will increase moderately during 1959-65, but requirements for blast furnace coke will show little change, as there should be some reduction in the rate of consumption. The requirements for metallurgical coke for blast furnaces are estimated at 2.6 million tons in 1965, based on production of 2.2 million tons of pig iron 243/ and on consumption of 1.2 tons of coke per ton of pig iron. Imports of coke will remain close to the level of recent years, or approximately 2.2 million tons. Consumption of indigenous supplies of metallurgical coke in 1965 should amount to about 850,000 tons, including approximately 400,000 tons from the gas works. The total capacity of the August Bebel and Karl Marx Plants will be about 450,000 tons of coke suitable for use in blast furnaces. East Germany expects to have in operation a new coke installation at the August Bebel Plant to replace the existing plant, which is more than 45 years old. The new plant will have a capacity of 370,000 tons, including about 70 percent in the metallurgical grades. 244/

D. Hungary

The deposits of coking coal in Hungary, with reserves estimated at approximately 50 million tons,* provide a poor base for the country's coke industry. The only coals that can be used for making metallurgical

* Proved reserves of hard coal, which consist almost entirely of bituminous coals, were established at 250 million tons in 1955, but only 21 percent were considered to be of coking grade. 245/

coke are found in some of the seams of the Mecsek area in southern Hungary, but even these require extensive and costly preparation because of their high contents of ash and sulfur. The yields of cleaned coal for coking are relatively low (23 percent for Komlo coals), and the product requires blending with imported coals. The Danube Iron Works, for example, used blends in 1958 consisting of 71 percent domestic coals and 29 percent imported coals. 246/ The total output of raw bituminous coal amounted to 2.85 million tons in 1960, 247/ but only about 450,000 tons of processed coal could be used at the coke plants. It is believed that production of bituminous coal may not exceed 3 million tons in 1965, although strong efforts are expected to be made to increase substantially the quantity that can be coked.

According to plans, production of pig iron in Hungary will increase from 1.25 million tons in 1960 248/ to nearly 1.8 million tons in 1965, 249/ and the rate of consumption of coke at blast furnaces will be reduced from 1.05 tons to 1 ton. During the same period, indigenous supplies of metallurgical coke should increase from 500,000 tons to about 650,000 tons. 250/ In 1958 the standards for coke had to be lowered to permit the use of more domestic coal. The ash content of dry coke is now about 14 to 15 percent, and the yield of metallurgical grade (larger than 40 mm) has been reduced from 79 to 75 percent. 251/

Imports of coke are expected to increase from about 1 million tons in 1960 to 1.3 million tons in 1965. On the other hand, imports of coking coal, which amounted to 350,000 tons in 1960, may not increase, provided that the indigenous supply of prepared coals, suitable for charging at the ovens, can be increased to 800,000 tons as planned.

E. Rumania

Although Rumanian reserves of bituminous coal are sizable,* efforts to develop an indigenous supply of coking coal have been only partially successful, and growth of iron smelting above current levels will be dependent to a large extent on imported coal and coke. This situation exists because reserves of strongly caking coals are very limited, and all of the coals that can be used in the blends contain excessive quantities of ash and sulfur, creating a difficult problem of preparation and a low yield of cleaned coal. Of approximately 4.3 million tons of bituminous coal mined in 1960, only about 0.9 million tons could be used at coke plants. Such coal has to be blended with imported coal to make satisfactory coke for blast furnaces. The 1960 Plan called for an output of coking coal sufficient to make only 40 percent of the coke required.

* It was stated in 1958 that the reserves of the Jiu Valley, Rumania's largest and best coal basin, would alone insure the fuel supply of the country for 150 years. 252/

Rumania's blast furnaces consumed about 1.2 million tons of coke in producing 1 million tons of pig iron in 1960. Assuming that 2 million tons of pig iron are produced in 1965 as planned and allowing for increased efficiency in coke consumption, the requirements for coke will rise to about 2.2 million tons. Deficiencies in indigenous production in 1960 were met by importing about 0.7 million tons of coke and 0.3 million tons of coking coal. By 1965 it is expected that production of coke of metallurgical grade will approximate 1 million tons, contrasting with only 0.6 million tons in 1960, and that imports will rise to nearly 1.2 million tons of coke and about 0.8 million tons of coal. The USSR apparently will be the major supplier of these fuels. According to the trade agreement signed in November 1960, the USSR will ship about 3 million tons of coke and about 1 million tons of coal to Rumania during 1961-65. 253/

F. Bulgaria

During the past decade, Bulgaria has produced between 10,000 and 25,000 tons of coke annually from coals mined in the Balkan Basin, although the quality is not satisfactory for use in large blast furnaces. In 1960, imports of coke, mainly from Czechoslovakia and the USSR, are estimated to have amounted to 327,000 tons, but the requirements will increase substantially, as production of pig iron is scheduled to increase from approximately 189,000 tons in 1960 254/ to 1.4 million tons in 1965. 255/ Assuming that the rate of coke consumption drops from 1.4 tons per ton of pig iron in 1960 to about 1 ton in 1965, the requirements for metallurgical coke (larger than 40 mm) will amount to about 1.4 million tons, about 0.8 million tons of which are planned to be imported. Such imports may have to be increased considerably in view of the necessity of constructing a coke plant and developing production of coking coal in order to meet domestic goals. Present plans call for construction of two batteries of coke ovens at the new Kremikovtsi Metallurgical Combine near Sofia. These installations will utilize about 620,000 tons of concentrates from the Balkan Basin and 380,000 tons of gas coals imported from Poland. 256/ Significantly, Bulgarian coals have poor caking capacity, and reserves are relatively small in the Balkan Basin.*

G. Albania

Albania produces no coke and apparently has no deposits of coking coal. Future needs for coke, as in the past, will be satisfied by imports, which have amounted to about 10,000 tons annually.

* The total reserves of bituminous coal were estimated at 43 million tons in 1958. 257/

APPENDIX A

CLASSIFICATION OF COALS IN THE USSR

The classification of coals is based mainly on the content of volatile matter in terms of dry, ash-free coal; heat values; and caking capacity. Bituminous coals in the USSR are divided into 6 categories or types for the purpose of estimating reserves, but there are now 10 categories of these coals based on the degree of caking capacity. Thus the so-called steam-fat coals (type PZh), ranging from medium to high content of volatile matter, have been divided into coals of three types -- GZh, Zh, and SS -- and the old standard classification for low-volatile coals (type PS) apparently has been discarded or at least is little used. This particular type (12 to 18 percent volatile) has been largely superseded by a new class of so-called lean-caking coals (type OS) with a volatile content of 14 to 22 percent and includes some of the coals formerly included in type K (coking). Certain other coals formerly classified in type K (18 to 27 percent volatile) have been reclassified as types KZh, K_2, and SS. The volatile content of type SS, or the class of weakly caking coals, may range from 17 to 37 percent, spanning the range from low to high volatile coals. Any bituminous coals with a relatively low content of volatile matter which, after coking, provide a residue that is pulverulent, sticky, and weakly sintered are referred to as type T.

The characteristics of the various classes of bituminous coals in the USSR are as follows:

Long-flame coals (D -- dlinno-plamennyy) are characterized by low caking capacity and a very high content of volatile matter (more than 42 percent). The nonvolatile residue is either a weak cake or powder, depending on the yield of volatile matter.

Gas coals (G -- gazovyy) are characterized by average or reduced caking capacity and a high content of volatile matter (35 to 44 percent). The coke of these coals has a larger number of cracks.

Gas-fat coals (GZh -- gazovyy-zhirnyy) are characterized by average to high caking capacity with medium to high content of volatile matter (30 to 37 percent). The coals are fusing, but the coke is weak.

Fat coals (Zh -- zhirnyy) are characterized by very high caking capacity with medium to high content of volatile matter (27 to 35 percent). The coke of these coals has relatively little strength.

Coking-fat coals (KZh -- koksovyy-zhirnyy) are characterized by strong caking capacity with medium to low content of volatile matter (18 to 27 percent) and provide coke that is tough or stable but with cracks.

Coking coals (K_1 -- koksovyy) are characterized by average caking capacity with medium to low content of volatile matter (18 to 27 percent) and provide dense, strong coke without cracks.

Secondary coking coals (K_2 -- koksovyy vtoroy) are characterized by somewhat lower caking capacity than type K_1 with medium or somewhat low content of volatile matter and provide dense, strong coke.

Lean-caking coals (OS -- otoshchennyy spekayushchiysya) are characterized by low caking capacity with low to medium content of volatile matter (14 to 22 percent). The coke consists of a weak cake that is easily subject to abrasion.

Weakly caking coals (SS -- slabospekayushchiysya) are characterized by low caking capacity with medium to high (SS_1 -- 25 to 37 percent) or low to medium (SS_2 -- 17 to 25 percent) content of volatile matter. A definite yield of volatile matter provides a nonvolatile residue that consists either of a weak coke or of powder but that is more carbonized than the coke obtained from coals of type D.

Lean coals (T -- toshchiy) are characterized by an absence of caking capacity and a very low content of volatile matter (9 to 17 percent). Sintered coke is not obtained from these coals.

APPENDIX B

METHODOLOGY

The derivation of estimates shown in Table 10* for the consumption of coke in production of lead, zinc, and copper and of synthetic ammonia and calcium carbide are given in Tables 17 and 18, below.

* P. 35, above.

Table 17

Estimated Consumption of Coke in Production of Lead, Zinc, and Copper in the USSR
Selected Years, 1955-60, and 1965

Thousand Metric Tons

Year	Production of Refined Lead a/	Consumption of Coke for Lead b/	Production of Distilled Zinc c/	Consumption of Coke for Zinc d/	Production of Blister Copper e/	Consumption of Coke for Copper f/	Total Consumption of Coke
1955	258	163	30	120	125	35	318
1958	288	181	30	120	125	35	336
1959	294	185	30	120	125	35	340
1960	300	189	30	120	125	35	344
1965	404	255	30	120	125	35	410

a. [redacted] For 1960, production was estimated to be about 2 percent larger than in 1959. 50X1

b. Approximately 630 kilograms of coke are consumed per ton of lead produced. 259/

c. Coke is used in production of distilled zinc but not in production of electrolytic zinc. Output of distilled zinc represents approximately 10 percent of the total output of zinc, or about 30,000 tons. It is assumed that capacity for distilled zinc will not increase significantly by 1965.

d. In production of distilled zinc, 4 to 5 tons of coke are consumed per ton of zinc produced. 260/ The lower figure is believed to be more correct.

e. Including only output of the Ural plants. Other plants are not believed to be large consumers of coke. Output of the Ural plants is assumed to be fairly constant throughout the period.

f. Based on very rough calculations and analogies with practice at a smelter in the former Belgian Congo. 261/

Table 18

Estimated Consumption of Coke in Production of Synthetic Ammonia and Calcium Carbide in the USSR
Selected Years, 1955-60, and 1965

Thousand Metric Tons

Year	Total Production of Synthetic Ammonia a/	Synthetic Ammonia from Coke b/	Consumption of Coke for Synthetic Ammonia c/	Production of Calcium Carbide a/	Consumption of Coke for Calcium Carbide d/	Total Consumption of Coke
1955	753	301	542	410	256	798
1958	967	290	522	515	322	844
1959	1,007	252	454	550	344	798
1960	1,100	253	455	585	366	821
1965	2,420	242	436	1,000	625	1,061

a. Estimated.

b. [redacted] the percent of the total synthetic ammonia produced from coke was planned to decrease from 40 percent (apparently in 1955) to 16 percent in 1960. It is estimated that 40 percent of the total synthetic ammonia in 1955 was produced from coke, 30 percent in 1958, 25 percent in 1959, and 23 percent in 1960 and that about 10 percent will be produced in 1965. 50X1

c. In US practice, about 1.8 tons of coke are required per ton of synthetic ammonia.

d. About 0.625 ton of coke is required per ton of calcium carbide. This amount is an average of the consumption coefficients of 6.60 to 0.65 [redacted] 50X1

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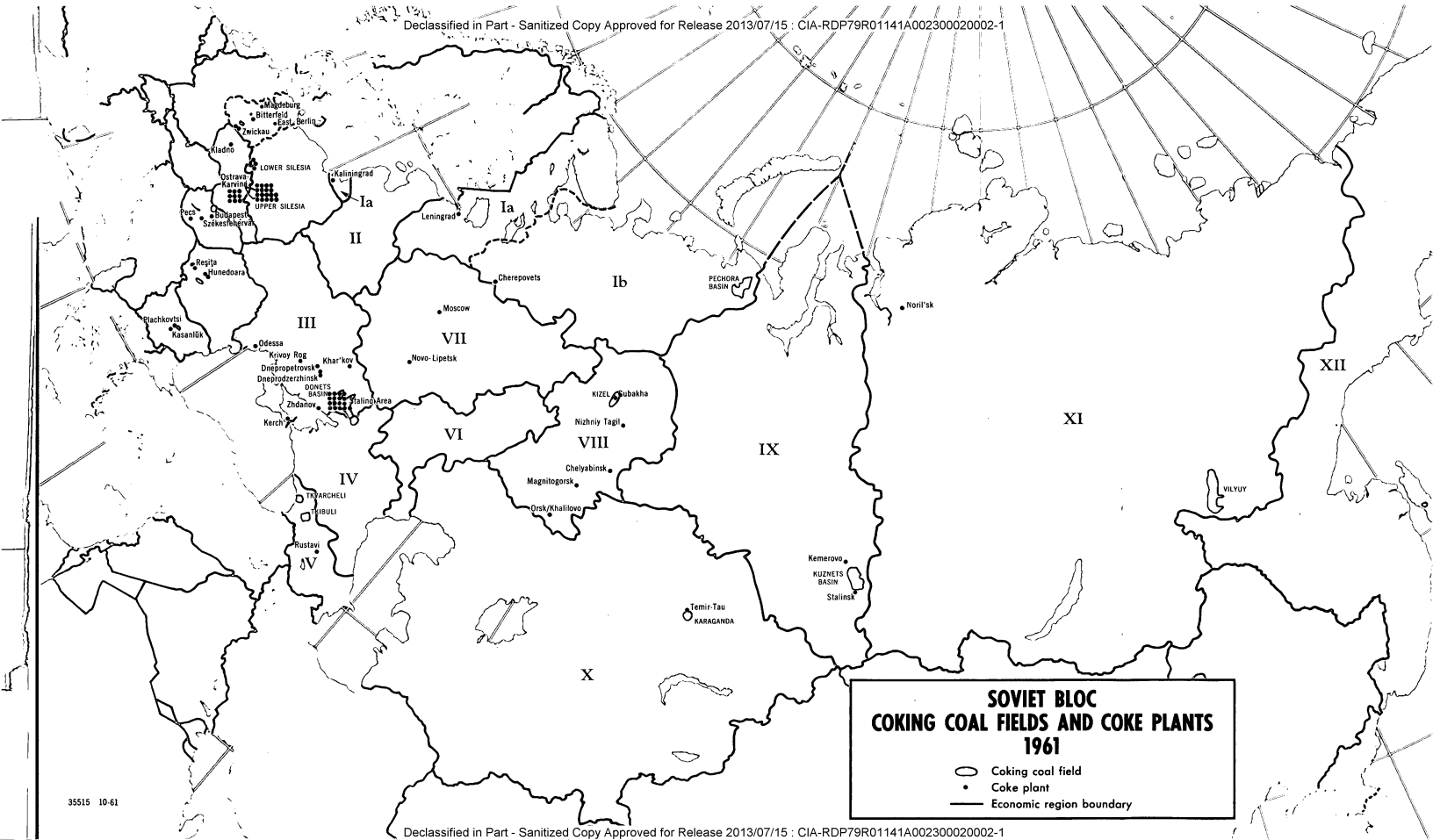

SOVIET BLOC
COKING COAL FIELDS AND COKE PLANTS
1961

Coking coal field
Coke plant
Economic region boundary

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