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**Economic Intelligence Report**

**SURVEY OF THE SOVIET STEEL INDUSTRY  
MIDWAY IN THE SEVEN YEAR PLAN (1959-65)**



CIA/RR ER 62-27

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**CENTRAL INTELLIGENCE AGENCY**

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FOREWORD

More than 3 years have elapsed since the Seven Year Plan (1959-65) for the ferrous metals industry of the USSR was put into effect. Some original objectives of the plan have been revised. The basic pattern of development envisaged, however, remains essentially as outlined in the original plan and can now be appraised in the light of results of the experience of the first 3 years and the prospective trends in 1962. The record to date not only provides a basis for evaluating the feasibility of the Seven Year Plan for the industry but also gives implications of the current plan that extend well beyond 1965. The pattern of principal technical developments underlying the program for 1959-65 provides a nucleus around which Soviet planners are formulating tentative plans for ferrous metallurgy during the next decade and beyond.

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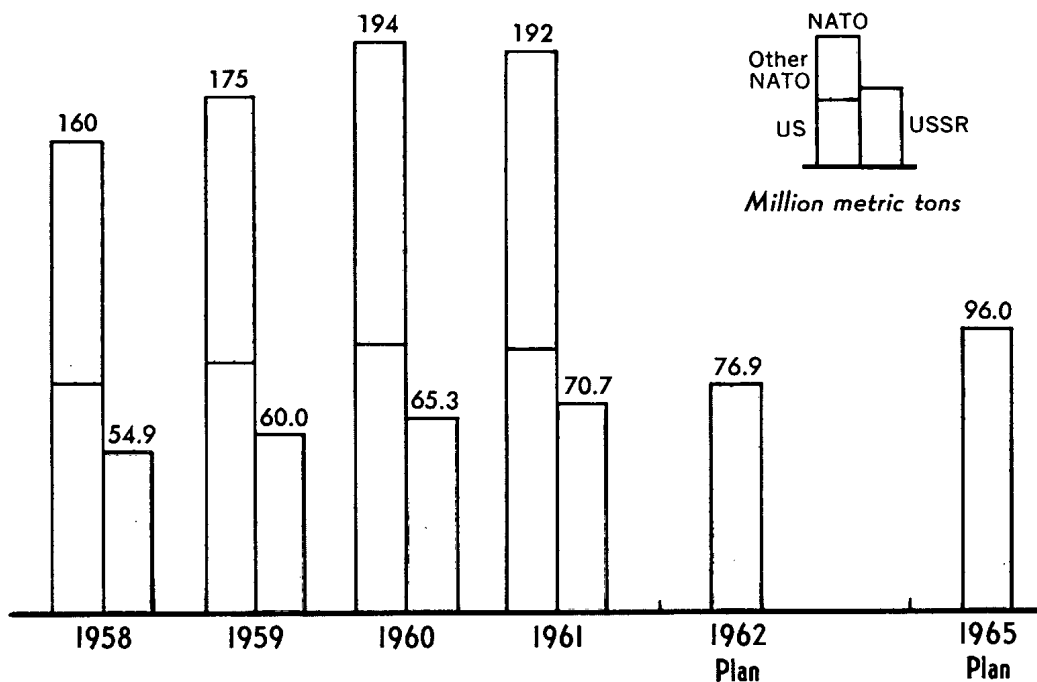
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SURVEY OF THE SOVIET STEEL INDUSTRY  
MIDWAY IN THE SEVEN YEAR PLAN (1959-65)\*

Summary and Conclusions

Production of steel in the USSR during 1959-61 exceeded the original goals in the Seven Year Plan and (except for a slight shortfall in 1961) the revised goals also. In 1961, 70.7 million metric tons\*\* of crude steel and 55.2 million tons of rolled steel were produced compared with plan goals of 71.3 million tons and 55.3 million tons, respectively. Output of crude steel in 1961 equaled 37 percent of that in NATO countries and almost 80 percent of that in the US -- somewhat larger proportions than the ratios of 34 percent and 71 percent, respectively, in 1958. Production in the USSR and in NATO countries is shown in the accompanying chart.



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\* The estimates and conclusions in this report represent the best judgment of this Office as of 1 July 1962.

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

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Although output of steel exceeded the plan goals during the first 3 years of the Seven Year Plan, the expansion program for ferrous metallurgy is operating less smoothly than was planned. Investment goals have been underfulfilled each year, the largest disparity occurring in 1961, when investment, estimated to have been 1.33 billion rubles,\* was almost 20 percent less than the 1.64 billion rubles in the plan. Part of the new capacity planned for 1961 was near completion at the end of the year and was put in operation during the first quarter of 1962. At the end of that quarter, however, about 1.1 million tons of blast furnace capacity, 1 million tons of steelmaking capacity, and possibly 1.5 million tons of rolled steel capacity remained unfinished.

The growth in the total production has not been seriously affected by delays in commissioning new capacity, nor is it likely to be during 1962-65 unless current problems increase materially. Output of crude steel probably will amount to about 76.9 million tons in 1962 as planned and approximately 96 million tons in 1965, the latter amount representing the revisions of the original goal of 91 million tons. Shortfalls in putting new units into operation have been more than offset, in their effect on production, by increasing output of existing facilities and probably by continued operation of obsolete units. Of the net increases planned for production in 1959-65, increases from existing facilities are planned to account for about 25 percent of the growth in production of pig iron and rolled steel and for up to 40 percent of the increase in crude steel. The problems arising from both planning concepts and their implementation, however, could make it increasingly difficult for the industry to retire obsolete capacity in the amounts planned and to achieve the quality and variety of steel mill products and the cost reductions planned for 1959-65.

Since the beginning of the Seven Year Plan period the USSR has commissioned 11 new blast furnaces having a total annual capacity of about 10.4 million tons of pig iron. Two of the furnaces (totaling 2.2 million tons of capacity) were scheduled for 1961 but were put in operation in the first quarter of 1962. At the end of that quarter, one additional blast furnace that was planned for 1961 was still under construction. A total of 30 million tons of new blast furnace capacity is planned for 1959-65, of which about 24.5 million tons are to be in operation by the beginning of 1965. Furnaces with a total capacity of 2.9 million tons are to be retired during 1959-65.

Significant increases in effective capacity of blast furnaces are being obtained in the USSR, as in the US and other Western steel-producing countries, from the use of well-prepared raw materials, auxiliary

\* Ruble values in this report are given in new rubles established by the Soviet currency reform of 1 January 1961. A nominal rate of exchange based upon the gold content of the respective currencies is 0.90 ruble to US \$1. This rate, however, should not be interpreted as an estimate of the equivalent dollar value of similar US goods in the steel industry.

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fuels and oxygen in conjunction with high top pressure, high blast temperatures, and other modern practices. The Soviet industry relies heavily on the use of sintered ores, mostly self-fluxing sinter, and is increasing total sintering capacity by substantial amounts. The industry is less advanced in more complex methods of beneficiating iron-bearing materials. Pelletizing, for example, has progressed only to the pilot plant stage, although there are plans to construct about 20 million tons of capacity for production of iron ore pellets.

The USSR has commissioned about 13.7 million tons of new crude steel capacity since the beginning of the Seven Year Plan period. Thirty-three open-hearth furnaces and 11 electric furnaces have been put in operation. All electric furnaces planned for 1959-61 were installed in those years, but seven open-hearth furnaces were unfinished at the end of 1961, 4 of which were completed in the first quarter of 1962 and 3 scheduled for later in 1962. Five additional open-hearth furnaces and five electric furnaces are planned for 1962. A total of 36 million tons of new crude steel capacity is to be commissioned during 1959-65, of which 28 million to 30 million tons are to be in production by the beginning of 1965. About 2 million tons of obsolete crude steel capacity are to be taken out of production in 1959-65.

The use of oxygen in steelmaking -- a major development in the US and other Western countries -- has developed less rapidly in the USSR than was planned and lags behind the US in important respects. Plans are not being met, mainly because of extended delays in designing and manufacturing the required oxygen-generating equipment and basic oxygen converters. The USSR has installed no new basic oxygen converters since the plan period began. There are seven units in operation which are estimated to have produced 2.5 million tons of steel in 1961 compared with 3.6 million tons in the US. The USSR plans to build two top blown basic oxygen converters in 1962, which are expected to be in production in 1963, and to build six more in 1963. Oxygen injection practices were in use in 8 open-hearth shops, having a total of no more than 50 furnaces, in 1960. About 225 open-hearth furnaces in the US are equipped for oxygen injection.

Nine rolling mills commissioned in the USSR in 1959-61 have a total capacity of 10.9 million tons, or about 1.5 million tons less than was planned to be commissioned in those years. The shortfall occurred in 1961 and resulted mainly from a failure to install four of the five cold rolling mills that were in the plan for 1961. Whether these four mills, one of which reportedly was nearing completion early in 1962, are among the five to be commissioned in 1962 is not clear.

More serious delays in installing new rolling mills will have to develop in 1962-65 to jeopardize the goals for production of 59.2 million tons of rolled steel in 1962 and 73.6 million tons in 1965. A



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continuation of present trends, however, could well prevent achieving the steel mill product mix planned for 1965. During 1959-65 a total of 29 million tons of new rolled steel capacity is to be commissioned, of which 25.2 million tons are to be in production by the beginning of 1965. Even the installation of all the rolling and finishing facilities planned would not necessarily assure the improved product mix envisaged in the plan, however. Revisions of state standards and the provision, in production plans, of incentives based on quality as well as tonnage appear to be equally important.

The Soviet steel industry continued development of continuous casting facilities. Six industrial-scale plants are in operation for research and developmental purposes, and five are planned. Production in 1961 exceeded 700,000 tons and is planned at 1 million tons in 1962 and 8 million tons in 1965.

Progress is being made in mechanizing labor-consuming operations in ferrous metallurgy and in designing, producing, and adopting automatic controls of processes and operations, but accomplishments are somewhat behind the plan. Both in mechanization and in automation the Soviet steel industry at best is no more advanced than that in the US and in general lags behind the US. Soviet research appears to be of a high caliber; problems arise from delays in designing and producing the necessary instruments and other mechanisms and in applying the product of research to industrial operations. A basic deterrent to automation in the Soviet steel industry is the relatively low level of mechanization, and until considerable improvement is made, advanced applications of automatic controls will be greatly delayed.

The pattern of Soviet foreign trade in ferrous raw materials and products in 1959-61 was essentially the same as in previous years. The USSR remained a net exporter of raw materials and steel to the European Satellites, a net exporter of steel to Communist Asia, and a net importer of rolled steel from the industrial West. Exports of rolled steel were almost 3.0 million tons and imports 1.5 million tons in 1960, the latest year for which data are available.

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## I. Introduction

Production of crude steel in the USSR rose to 70.7 million tons in 1961 and is planned to increase to 76.9 million tons in 1962, as shown in Table 1.\* The volume of output in 1961 represented an over-all increase of 15.8 million tons, or 29 percent, since the beginning of the Seven Year Plan in 1959. By comparison, production in NATO countries increased 32 million tons (20 percent), including increases of 12 million tons (15 percent) in the US and 20 million tons (25 percent) in other NATO countries, as indicated by the data in Table 2.\*\* The rate of increase in production was greater in the USSR than in the US or in the other NATO countries, and Soviet production equaled 37 percent of NATO output and almost 80 percent of US production in 1961, a slight increase from the 1958 ratios of 34 percent and 71 percent, respectively. On a per capita basis, however, Soviet production in 1961 amounted to only 325 kilograms (kg) compared with US production of 484 kg. Furthermore, in terms of crude steel capacity the margin in favor of the US is considerably larger. Soviet production in 1961, which equates to Soviet capacity,\*\*\* was only about 50 percent of estimated US capacity at the beginning of 1960.

Early in the Seven Year Plan period, Soviet planners became convinced that higher levels of production and consumption of steel could be achieved in 1965 than were envisaged in the plan. The heightened optimism was based in part on the above-plan levels of production obtained in 1959. Revised goals were established for 1960 and were exceeded, except for a slight shortfall in production of pig iron. Some time in 1960 or early in 1961 the Seven Year Plan for the ferrous metallurgical industry†

\* Table 1 follows on p. 6.

\*\* Table 2 follows on p. 7.

\*\*\* Soviet production of crude steel is equated to capacity because demand is set by the plan and not by market forces. Given adequate supplies of raw materials, output of crude steel would be a function of maximum furnace capacity, factored by normal reductions caused by repair, maintenance, and other down time.

† The term ferrous metallurgy as used in the USSR includes (1) the extraction and beneficiation of iron, manganese, and chrome ores; (2) the extraction of limestone and other nonmetallic mineral raw materials; (3) production of refractories; (4) production of electric furnace as well as blast furnace ferroalloys; (5) production of coke and coke-chemicals, pig iron, crude steel, and rolled steel; and (6) production of "metal articles," which include not only cold rolled strip, wire, and wire products but also certain consumer items. Plants considered to be a part of the ferrous metals branch of the Soviet economy produce about 88 percent of the country's total output of crude steel and 94 percent of the rolled steel. The remainder is made at machine building and other such plants. 1/ [redacted] 50X1

50X1

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Table 1

Production of the Ferrous Metallurgical Industry in the USSR  
 1958-61 and Planned for 1959-62 and 1965

Commodity	1958 <sup>a/</sup>	1959		1960		1961		Million Metric Tons		
		Plan <sup>b/</sup>	Actual <sup>c/</sup>	Plan <sup>d/</sup>	Actual <sup>c/</sup>	Plan <sup>e/</sup>	Actual <sup>c/</sup>	1962 Plan <sup>f/</sup>	1965 Plan	
									Original <sup>g/</sup>	Revised <sup>a/</sup>
Usable iron ore	88.8	92.7	94.0	105.5	105.9	116.5 <sup>h/</sup>	117.6	N.A.	150 to 160	167.5
Pig iron	39.6	42.7	43.0	47.1	46.8	51.2	50.9	56.0	65 to 70	72.5
Crude steel	54.9	59.0	60.0	64.9	65.3	71.3	70.7	76.9	86 to 91	96.0
Rolled steel	43.1	46.0	47.0	50.3	51.0	55.3	55.2	59.2	65 to 70	73.6

a. <sup>2/</sup>  
 b. <sup>3/</sup>  
 c. <sup>4/</sup>  
 d. <sup>5/</sup>

f. <sup>7/</sup>  
 g. <sup>8/</sup>  
 h. Estimated.

50X1

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Table 2

Production of Crude Steel in the USSR, the US, and NATO Countries  
1958 and 1961

	Total (Million Metric Tons)		Per Capita a/ (Kilograms)	
	<u>1958</u>	<u>1961</u>	<u>1958</u>	<u>1961</u>
USSR	54.9	70.7	265	325
NATO countries	160	192	346	398
Of which:				
US	77.3	88.9	444	484

a. Based on estimates of midyear population.

was revised. Instead of as much as 91 million tons of crude steel and 70 million tons of rolled steel, production in 1965 is now planned to be 96 million and 73.6 million tons, respectively.

Production of ferrous metals in 1961 was slightly less than was planned for the year on the basis of the revised goals for 1965, but the shortfalls were not significant, amounting to only 300,000 tons of pig iron, 600,000 tons of crude steel, and 100,000 tons of rolled steel. Output of crude steel was 8.3 percent larger than in 1960 -- a rate of growth consistent with the average annual rate required to meet the revised goals for 1965. In the current year, production is planned to increase 8.8 percent, or 6.2 million tons. Assuming that output attains the level planned for 1962, which seems likely, an annual rate of growth of only 7.7 percent during 1963-65 would assure production of 96 million tons of crude steel in 1965.

Although the planned rates of growth in production of ferrous metals are being achieved, the expansion program is proceeding less smoothly than was planned or is implied in some Soviet propaganda. There are problems at various levels both in planning concepts and in their implementation that are delaying the commissioning of new facilities and the application of technological advances in the industry. Such problems appear to arise from difficulties in centrally planning and implementing an increasingly large expansion program in an economy that is growing in complexity. Over-all production goals have not been seriously affected

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so far, nor will they be during 1962-65 unless current difficulties increase materially. It could become increasingly difficult for the industry to achieve other important objectives within the plan, however, such as the plans for improving the quality and variety of steel mill products, for retiring obsolete capacity, and for reducing costs of production. This report appraises the problems and progress of the key aspects of the plan in the related areas of investment, technological change, and product mix.

II. Investment in New Capacity

A. General

The investment program for the ferrous metals industry during 1959-65 greatly exceeds in size any previously undertaken during a comparable period of time. Investment is planned to be 10 billion rubles, of which about 6.32 billion rubles are for construction-assembly\* work and the remainder for equipment. 9/ Actual investment was 4.08 billion rubles in the preceding 7-year period (1952-58). Almost two-thirds of the total investment in 1959-65 is for expanding and modernizing mines and plants in existence at the beginning of the plan period. 10/ Only one new steel plant -- the Tayshet Metallurgical Plant in East Siberia -- is planned to be put under construction during 1959-65.\*\* When completed it will be a fully integrated plant having a crude steel capacity of perhaps 3.5 million tons, although there is evidence that final plans for the plant are yet to be established. No steel is to be produced at Tayshet by 1965, but 3 coke batteries are to be built and the plant's first blast furnace is to be completed in 1965.

The amount of investment planned for the components of ferrous metallurgy in 1959-65 is known only in part. One-third of the total (3.3 billion rubles) is for ore mining and concentrating facilities and the construction of sinter plants. 12/ Investment in the pipe and tube industry is planned to be 637 million rubles compared with an actual outlay of 311.4 million rubles in 1952-58. 13/ More than 100 million rubles are to be invested in oxygen plants for the ferrous metals industry 14/ and 450 million to 500 million rubles in intraplant transportation facilities. 15/ These amounts total 4.5 billion rubles, leaving about 5.5 billion rubles for investment in all other components of ferrous metallurgy.

\* Construction-assembly costs include the cost of constructing fixed buildings and structures and the cost of installing production equipment but not the cost of the equipment.

\*\* Twenty-four new installations are in the construction plan of the ferrous metallurgical industry, including (in addition to the steel plant) eight ore-mining enterprises, five refractories plants, three ferroalloy plants, one coke-chemical plant, one powder metallurgy plant, one pipe plant, three metal specialities plants, and one precision alloy plant. 11/

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Investment plans have been underfulfilled annually since the beginning of the plan period. The actual investment of about 1.02 billion rubles in 1959 (the amount indicated by a reported increase of 22 percent 16/ above the 840 million rubles invested in 1958 17/) was about 7 percent less than the 1.10 billion rubles planned for 1959. 18/ Investment in 1960 is estimated to have been 1.19 billion rubles,\* or about 7 percent less than the 1.28 billion rubles in the plan for that year.\*\* The underfulfillment was considerably larger in 1961, when investment, estimated to have been 1.33 billion rubles, was almost 20 percent less than the 1.64 billion rubles 25/ in the plan. Investment in 1962 is planned to be 1.47 billion rubles, 26/ an amount that is 10.6 percent 27/ larger than estimated actual investment in 1961 but is about 10 percent less than was planned for 1961. Investment in 1962 is to be directed primarily to the completion of projects unfinished at the beginning of the year.

Most of the new capacity to be commissioned during the 7-year period, which is shown in Table 3,\*\*\* will have to be in operation or near completion by the end of 1964, according to the plan for production. For example, the investment plan for the 7 years provides for commissioning new steelmaking facilities having a total annual capacity of 36 million tons of crude steel. In the production plan, new facilities are expected to account for output of 28 million to 30 million tons of crude steel in the last year of the plan period.

B. Iron Ore

Commissioning of new capacity for mining iron ore has been somewhat behind schedule so far in the Seven Year Plan period, but by increasing production of existing mines and probably by continuing to operate mines that otherwise would have been retired,† the industry has been able to maintain output of iron ore at levels above those planned for 1959-61. Annual production of crude iron ore is not reported by the USSR, but

\* The 1,468 million rubles planned for 1962 as reported in source 19/ and the planned increase of 10.6 percent in that year as reported in source 20/ indicate that actual investment in 1961 was about 1.33 billion rubles. Actual investment in 1961 was 11.5 percent larger than in 1960, according to source 21/, indicating a total of about 1.19 billion rubles in 1960. This amount is slightly less than the preliminary Soviet estimate of 1.25 billion rubles. 22/

\*\* The amount planned for 1960 was 25 percent larger than actual investment in 1959 according to source 23/ and 26 percent larger according to source 24/.

\*\*\* Table 3 follows on p. 10.

† Mines having a total capacity of 25 million tons are to be retired during 1959-65. 28/

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Table 3

New Capacity for the Ferrous Metallurgical Industry in the USSR <sup>a/</sup>  
 Commissioned 1952 - First Quarter 1962 and Planned for 1959-65

Type of Capacity	Million Metric Tons							
	Commissioned 1952-58 <sup>c/</sup>	Planned 1959-65 <sup>d/</sup>	Commissioned <sup>b/</sup>		Remainder Required 1962-65	Commissioned First Quarter 1962 <sup>e/</sup>	Additional Capacity Planned 1962 <sup>f/</sup>	Remainder Required 1963-65 <sup>g/</sup>
			1959-60	1961				
Blast furnace	16.3	30	6.2	2.0	21.8	2.2	4.2	15.4
Steelmaking	12.4	36	7.5	4.8	23.7	1.4	3.8	18.5
Rolling mill	6.8	29	8.0	2.9	18.1	N.A.	N.A.	N.A.

a. Excluding additions to capacity resulting from enlarging existing facilities and from technological and other sources of increased production from existing facilities.

b. Data for 1959-60 are residuals obtained by subtracting amounts commissioned in 1961 as reported in source 29/ from the totals for 1959-61 reported in source 30/.

c. 31/

d. 32/

e. Estimated capacities of 2 blast furnaces and 4 open-hearth furnaces that were scheduled for completion in 1961 but were not commissioned until early in 1962.

f. Estimated capacities of the remaining units not completed in 1961 (one blast furnace and three open-hearth furnaces) and capacities of additional facilities planned for commissioning in 1962 (three blast furnaces, five open-hearth furnaces, and five electric furnaces).

g. Assuming that plans for 1962 are fulfilled.

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output of usable iron ore\* in 1959-61 exceeded the original goals by 9 million tons and was 2.8 million tons in excess of the amount required by the revised annual plans.

The aggregate capacity of new mines put in operation during 1959-60 was only slightly less than was planned for those years. A total of 23 million tons of crude ore mining capacity was commissioned in 1959 33/ compared with the goal of 26.3 million tons. 34/ The plan for 1960 was essentially fulfilled with the commissioning of all but 1 million tons 35/ of the 31 million tons of capacity planned to be put in operation. 36/ The amount of new capacity commissioned in 1961 is unknown, although a sizable underfulfillment is indicated inasmuch as only 50 percent of the 40 million tons of capacity planned for construction 37/ had been commissioned by the end of November. 38/ In 1962, 34 million tons of ore mining capacity are to be put in operation. 39/ An average of about 30 million tons of such capacity will have to be commissioned annually during 1959-65 to fulfill the plan for constructing a total of 218 million tons of ore mining capacity.\*\* 40/

At least 12 iron ore concentrating plants are to be constructed during 1959-65, and production of concentrates is planned to increase from 32 million tons in 1958 to about 96 million tons in 1965. 41/ New concentrating plant capacity has been commissioned in the Krivoy Rog Basin, at the Kursk Magnetic Anomaly, and at other major deposits.

At a higher level of ore processing, it is estimated that the construction of 60 million tons of sintering capacity 42/ and 20 million tons of pelletizing capacity is planned for 1959-65. 43/ Production of sinter has increased substantially, from 50.8 million tons in 1958 to 74.1 million tons in 1961. 44/ Nineteen new sinter lines are to be installed in 1962. 45/ The total capacity of these new facilities is unknown but may be on the order of 15 million tons.\*\*\*

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\* The term usable iron ore as used in the USSR includes (1) iron ore that is used in blast furnaces and open-hearth furnaces without further processing and (2) the product of ore beneficiation plants (that is, concentrates, pellets, and sinter). Production of usable ore is not equal to the sum of output of shipping grade ore and of beneficiated ore, however, because shipping grade ores as well as poorer ores increasingly are being further processed in order to improve their physical and chemical properties.

\*\* Increases planned for capacity and production in the iron ore industry are based in part on the increasing amounts of ore that the USSR will supply the European Satellites. Shipments are planned to be about 25 million tons in 1965 compared with 11.8 million tons in 1958 and 14.8 million tons in 1960.

\*\*\* The total annual capacity of eight sinter lines to be installed in the Ukraine is 6 million tons 46/ or an [footnote continued on p. 12]



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After a number of years of research and development work the Soviet authorities claim to have in operation an industrial-scale pelletizing plant at Krivoy Rog, although a report by Western visitors to the plant describes it as being on an experimental scale. Production of 380,000 tons of pellets (possibly an annual rate in 1960 or 1961) is claimed, which is an amount more appropriate to an experimental plant than to a full-scale enterprise. Two additional plants, each with a capacity of 5.4 million tons, are said to be under construction in the Krivoy Rog Basin, and two more are to be built by the end of 1962 -- one at the Kachkanar deposit and one at the Sokolov-Sarbay deposit. The capacity of each of the latter plants is to be 5 million tons. 48/

Development of pelletizing in the USSR is considerably behind that in the US, and US plants were among the facilities that the USSR was most anxious to include in a recently discussed exchange agreement. US production of iron ore pellets in 1960 was 13.8 million tons, 49/ and annual capacity late in 1961 totaled 17.6 million tons. 50/ About 4.9 million tons of new capacity are scheduled to be put in operation in the US in 1962-63. 51/ In addition, plants in Canada that were largely financed by US companies and whose output is largely for consumption in the US have an aggregate capacity of 9.6 million tons, 52/ with 5 million tons in addition scheduled to be put in operation in 1962-63. 53/

C. Blast Furnaces

Soviet plans for 1959-61 provided for commissioning 12 new blast furnaces having an aggregate capacity estimated at 11.5 million tons. Nine of these furnaces, with a total capacity of 8.2 million tons, were in operation at the end of 1961, as shown in Table 3.\* Two furnaces with a combined capacity of 2.2 million tons were commissioned in the first quarter of 1962, but the remaining unit, having an annual capacity of 1.1 million tons, was still under construction.

Although the USSR has commissioned most of the new blast furnaces that were planned to be put in operation in 1959-61, time schedules have not been met. In 1959, when five furnaces were to be built, three were completed by the end of the year and one was commissioned in May 1960 and the other in July 1960. Three new furnaces were to be built in 1960 (excluding those carried over from 1959), of which two were completed

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average of 750,000 tons each. Assuming that this average applies to all lines to be installed in the USSR, a total capacity of 14.2 million tons is indicated. The largest capacity unit now in operation in the USSR reportedly has an annual capacity of 950,000 tons. 47/

\* P. 10, above.

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during the year and one was commissioned in June 1961. The plan for 1961 provided for four furnaces, of which one was in operation by the end of the year, two were brought in in February 1962, and one (under construction at the end of March 1962) is one of four furnaces in the plan for 1962.

The lags in commissioning new blast furnaces contributed to minor shortfalls in the annual plans for production of pig iron in 1960 and 1961.\* New furnaces, most of which must be in operation at the beginning of 1965, are planned to provide 24.5 million tons of pig iron in 1965, as shown in Table 4.\*\* With 10.4 million tons of new capacity installed as of the end of March 1962, achievement of this goal will require the commissioning of 14.1 million tons of additional capacity by the end of 1964. About 4.2 million tons of capacity are planned for 1962, and an average of nearly 5 million tons a year will be required in 1963-64. Through the first quarter of 1962, commissioning of new capacity was at an average annual rate of 3.2 million tons.

D. Steelmaking Facilities

A total of 12.3 million tons of crude steel capacity was commissioned in 1959-61. There were slight shortfalls in the first 2 years of the plan period, but most of the capacity planned for those years was completed by the end of 1960. New capacity commissioned in 1961 totaled 4.8 million tons compared with 7.2 million tons in the plan, although 1.4 million tons of capacity were near completion at the end of the year and were put in operation early in 1962. At the end of the first quarter of 1962 the over-all lag may have been approximately 1 million tons.

In spite of delays in commissioning new steelmaking capacity, production of steel in 1959-61 was about 0.8 million tons larger than required by the revised annual plans and reportedly was 9.2 million tons in excess of the original plan goals. 55/ New facilities built during the Seven Year Plan period are expected to account for output of 28 million to 30 million tons of steel in 1965. Thus 14.3 million to 16.3 million tons of new capacity must be completed during the remainder of the plan period, most of which should be in operation by the end of 1964. The annual rate of 5.2 million to 5.9 million tons\*\*\* that thus will be necessary is somewhat larger than even the best year's performance.

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\* Production of pig iron in 1959-61 was 1.6 million tons greater than was expected in the original control figures for those years 54/ but was 0.3 million tons less than the total revised annual plans.

\*\* Table 4 follows on p. 14.

\*\*\* Calculated on the basis of 2.75 years, which allows for capacity installed in the first quarter of 1962.

Table 4

Sources of Planned Increases in Production of Iron and Steel in the USSR  
 1959-65

						Million Metric Tons
	Actual Production <sup>a/</sup> 1958	Plus Increases in Production from:			Planned Production 1965 <sup>a/</sup>	
		New Units Put in Operation	Existing Units	Other <sup>b/</sup>		Less Retirements <sup>c/</sup>
Pig iron	39.6					
Original plan		19.5 <sup>d/</sup>	10.9 <sup>e/</sup>	2.9	70.0 <sup>f/</sup>	
Revised plan		24.5 <sup>g/</sup>	8.4 <sup>g/</sup>	2.9	72.5	
Crude steel	54.9					
Original plan		29.5 <sup>d/</sup>	8.6 <sup>e/</sup>	0	91.0 <sup>f/</sup>	
Revised plan		28.0 to 30.0 <sup>h/</sup>	14.0 to 16.0 <sup>h/</sup>	0	95 to 99	
Rolled steel	43.1					
Original plan		21.9 <sup>d/</sup>	7.0 <sup>e/</sup>	0	69.6 <sup>f/</sup>	
Revised plan		25.2 <sup>i/</sup>	7.6 <sup>i/</sup>	0	73.6	

- a. <sup>56/</sup>  
 b. These data represent the first year's production of blast furnaces commissioned late in 1958. <sup>57/</sup>  
 c. Retirements according to the revised plans are assumed to have been the same in the original plans.  
 d. Residual representing the amount required to achieve the net increase in production after allowing for production from existing units (and "other" sources in the case of pig iron) and for retirements.  
 e. <sup>58/</sup>  
 f. Upper limit of the plan.  
 g. <sup>59/</sup>  
 h. <sup>60/</sup>  
 i. <sup>61/</sup>  
 j. This figure represents production in 1960 of the mills to be retired, the total capacity of which was 3.0 million tons. <sup>62/</sup>

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The construction of new open-hearth furnaces was largely on schedule during 1959-60. Ten units were completed in 1959, as planned, and 9 of the 10 furnaces in the plan for 1960 were commissioned. The remaining furnace, at the Kazakh Metallurgical Plant, was not reported to be in operation until early in 1962. The plan for 1961 provided for constructing 17 open-hearth furnaces, including the unit not completed in 1960 at the Kazakh Metallurgical Plant, of which 10 were in operation at the end of the year, 4 were completed early in 1962, and 3 remained under construction at the end of March 1962. The plan for 1962 provides for the construction of five new open-hearth furnaces, 63/ excluding the seven units carried over from 1961.

Of the 33 open-hearth furnaces commissioned through the first quarter of 1962, 22 were built at 4 plants. Seven furnaces were put in operation at the Cherepovets and Magnitogorsk plants, five at the Krivoy Rog plant, and three at the Ilyich-Zhdanov plant. At least four of the furnaces built at these plants are 600-ton units, and the remainder are 500-ton units or larger. More than one-half of the new open hearths to be built in 1959-65 are to be 500-ton to 600-ton furnaces. 64/

Plans for installing electric furnaces were met in 1959-61 with the commissioning of 11 new furnaces. A total of 25 electric furnaces is to be put in operation during the Seven Year Plan period. The USSR is considerably behind the US in the design and operation of this type of steelmaking facility. The largest electric furnaces installed in the USSR have rated capacities of 80 tons, although their actual output in some cases ranges up to 90 to 100 tons. Development of larger units has been greatly delayed. Designing of a 180-ton furnace was undertaken in 1956, 65/ but development work was still underway in January 1961. 66/ Furnaces of this size have been in operation in the US industry for a number of years, and units with capacities of 200 tons or more have been installed. Soviet interest in electric furnace technology in the US is evidenced by the inclusion of this phase of steelmaking operations in Soviet proposals concerning the US-USSR technical exchange program.

The most conspicuous Soviet lag, relative to developments in the US and other major Western steelmaking countries, is the failure of the USSR to install any new, basic oxygen converter capacity during 1959-61. The USSR has a total of seven top blown oxygen converters installed at two plants (the Krivoy Rog Metallurgical Plant and the Petrovsk Metallurgical Plant in Dnepropetrovsk 67/), all of which were built before the beginning of the Seven Year Plan period. 68/ Bessemer converters have been adapted to the use of oxygen, but the USSR has constructed no additional basic oxygen converters of the type which, in the West, represents one of the major developments in steelmaking.

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The USSR has about 3.8 million tons of basic oxygen converter capacity, 69/ but, because of technical and other problems, the units have operated considerably below capacity. Production in 1961 is estimated to have been 2.5 million tons, which is little more than double the output of 1.2 million tons in 1958. 70/ During the same period, output in the US increased from 1.2 million to 3.6 million tons. US capacity, which was 3.7 million tons at the beginning of 1959, 71/ is estimated to have been 6.8 million tons at the beginning of 1962 72/ and on the basis on present plans is expected to total 10.2 million tons by the beginning of 1965. 73/

In the USSR, two 100-ton converters are to be built in 1962 and are to be in production in 1963, and six additional units of this size are to be built in 1963. 74/ Designing of 250-ton converters is to begin in 1962. 75/ The largest units in the US (which are to be in operation in 1962) have a rated capacity of 272 tons. 76/

The significance of the Soviet lag in developing basic oxygen converter capacity is not the effect on total production of steel, because production goals are being exceeded. The lag is important in view of the Soviet effort to increase production rapidly, the relatively low capital investment required per ton of capacity for oxygen converters compared with open-hearth furnaces, and the high production rates (and lower production costs) of converters.\* Various reasons for the lag have appeared in Soviet reports. Representatives of the Central Scientific Institute for Ferrous Metallurgy attribute it to faulty planning and to indecision at Gosplan, USSR, and the State Economic Council. 79/ Representatives of Gosplan, however, attribute it to "the backwardness of industry in developing new types of equipment," 80/ a criticism that is concurred in implicitly by the director of one of the two Soviet steel plants presently operating oxygen converters. 81/

Indecision at the planning levels probably has been based mainly on reservations concerning the wisdom of greatly increasing investment in converter capacity in view of the lack of significant progress in the technology of oxygen converter design and operation relative to that in open-hearth furnace technology. Converter technology has improved but is less advanced in the USSR than in the US, according to reports in Soviet technical journals. 82/ Moreover, technical advances in open-hearth furnace operations in the USSR as in other countries (notably the use of oxygen) were increasing production rates substantially. At the same time, however, serious difficulties were being encountered in designing and producing large-capacity facilities for generating oxygen.

\* The record heat at one US plant is 175 tons in 43 minutes for a rate of 244 tons per hour, 77/ while good open-hearth furnaces in the US produce at the rate of 36 tons per hour, tap-to-tap time. 78/

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The BR-2 unit, which is capable of producing oxygen at a rate of 35,000 cubic meters (cu m) per hour, 83/ was not designed until 1960, and the first unit was produced only in 1961. 84/ It was intended to be put in operation (at the Azovstal' steel plant) in the fourth quarter of 1961 and, on the basis of its performance there, to be produced serially beginning in 1962. 85/ The unit had not been assembled as of mid-January 1962, however.

In view of the technical problems involved, the converter program may well have been delayed at the Gosplan level during 1959-60 in the expectation of success in purchasing the Austrian-owned Linz-Donawitz (L-D) process. Inability to reach agreement on the method of payment (in hard currency or commodities) apparently has forestalled conclusion of the deal, which would provide the USSR with at least one L-D plant having a capacity of 2 million tons or more, including complete technology and oxygen-generating facilities. 86/

E. Rolling and Finishing Capacity

The USSR plans to commission 23 million to 29 million tons of rolled steel capacity during 1959-65 and to have in operation enough new mills to provide 25.2 million tons of the 73.6 million tons of rolled steel to be produced in 1965. The new facilities not only will substantially increase total output of rolled steel in the USSR but also are expected to materially improve the quality and variety of steel mill products available to steel-consuming industries.\* The number of some types of rolling mills in operation in 1958 and planned to be in production in 1965 is shown in Table 5.\*\*

During 1959-65, 55 new hot rolling mills 87/ and 11 cold rolling mills 88/ are to be put in operation. Among the hot rolling mills to be commissioned are 13 plate and sheet mills having an aggregate annual capacity of 21.6 million tons 89/ -- enough to increase the total of such capacity in the industry to about 36 million tons by the end of the plan period after allowing for retirement of some obsolete capacity. The industry plans to retire 91 rolling mills which, although having a total capacity of about 3 million tons, 90/ in 1960 produced about 2.4 million tons. 91/ Among these are 52 plate and sheet mills which in 1960 produced about 1 million tons of products. 92/ Some obsolete capacity is being retained on a standby basis to be used for producing small-lot runs. 93/

In addition to new rolling mills, the plan provides for a substantial increase in heat treating facilities, a type of equipment

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\* For a discussion of planned changes in the product mix, see IV, p. 26, below.

\*\* Table 5 follows on p. 18.

Table 5

Selected Types of Rolling Mills in Operation in the USSR a/  
1 January 1959 and Planned for 1 January 1966

Type of Mill	Mills in Operation 1 January 1959		Mills Planned to be in Operation 1 January 1966	
	Number	Production in 1959 (Thousand Metric Tons)	Number	Capacity (Thousand Metric Tons)
Pipe billet	3	1,269	3	1,850
Rail-structural	5	4,544	5	5,350
Strip (skelp)	3	932	4	2,420
Large bar	55	8,099	43	13,249
Medium bar	29	3,797	31	8,236
Small bar	36	3,670	36	7,722
Special section bar	0	0	3	172
Wire	16	2,932	19	6,225
Plate and sheet	.144	11,680	104	35,933

a. 94/

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considerably less advanced and less widely used in the USSR than in the US. New finishing line equipment to be installed includes continuous galvanizing and electrolytic tinning lines, which also are facilities in which the USSR lags.

A large increase in pipe mill capacity is planned, particularly in facilities for production of large-diameter pipe required for the gas and oil pipeline program.

The USSR has put in operation a total of 10.9 million tons of rolling mill capacity since the beginning of the Seven Year Plan period. Annual plans were met in 1959-60, but in 1961 only 2.9 million tons of new capacity were commissioned of the 4.4 million tons planned for the year. <sup>95/</sup> The lag in 1961 was mainly in commissioning cold rolling facilities: five such mills were to have been put in operation, but only one was commissioned by the end of the year. Continued delays during the remainder of the plan period would jeopardize achievement of plans for improving the rolled steel product mix and for retiring obsolete capacity. Unless current problems multiply, however, the goal for the total production of rolled steel in 1965 still can be achieved.

Deficiencies in output of rolling mill equipment partly explain the delays in putting new facilities in operation. Long lead times are characteristic of the designing, production, and installation of rolling and finishing equipment in the USSR. In terms of the weight of equipment produced, output was smaller in 1958 than in either of the 2 preceding years, dropping from 111,300 tons in 1956 to 96,100 tons in 1957 and 86,900 tons in 1958.\* The level of production increased to 102,300 tons in 1959 and 120,600 tons in 1960. <sup>96/</sup> In 1961, however, output was estimated to be 110,000 tons, which not only was significantly less than was planned (150,000 tons) but was below the 1960 level.

All the blame for the lag in commissioning new rolling mills cannot be assigned to the machine building industry, however. Basic rolling mill assemblies, once delivered to the steel plant, frequently became operative after the planned date because of lagging deliveries of other equipment. Faulty coordination of deliveries, in turn, frequently can be attributed to deficiencies at the planning and administrative levels. Although the significance of such problems can be overestimated, the record to date clearly indicates that strains exist in the planning, designing, production, and installation of new rolling and finishing facilities -- strains that could make it increasingly difficult for the industry to supply the variety and quality of steel mill products planned for 1965.

\* Data on production of rolling mill equipment include that produced for the nonferrous as well as the ferrous metals industry.



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Four primary mills, including three blooming mills and one slabbing mill, have been commissioned since the plan period began. Two of the blooming mills were commissioned early in 1962, 3 months behind schedule in each case. Another blooming mill was planned for 1961 but was not completed and has been rescheduled for 1962. At least four more are to be installed during the remainder of the plan period, some of which are to be 1,300-millimeter (mm) mills which are of recent design and are said to be fully automated and to have an annual capacity of 5.5 million to 6 million tons. 97/ A slabbing mill, originally scheduled for 1958, was commissioned at the Magnitogorsk plant in March 1959. An 1,150-mm slabbing mill, described as having the largest capacity of any such mill in the USSR, was nearing completion in January 1962 at the Ilyich-Zhdanov plant. Slabs rolled from ingots weighing up to 35 tons will supply the plant's 1,700-mm sheet mill, which was completed in 1960. 98/

Two plate mills and four hot rolled sheet mills have been put in operation. The two plate mills, each of which is a 3-stand (two 2-high, one 4-high), 2,800-mm mill with a rated capacity of 800,000 tons a year, were installed at the Cherepovets (1959) and Novo Troitsk (1960) plants. There were plans for installing a 4,200-mm plate mill at the Novo-Lipetsk plant, to be used, at least in the near future, to supply wide plate for production of 1,020-mm line pipe. This plan was canceled in 1961, when it was decided to install spiral-welding facilities at various plants for production of 1,020-mm and other large-diameter line pipe.\* 99/ Hot sheet mills installed to date include a continuous, 12-stand, 2,500-mm mill at Magnitogorsk (1960), a semicontinuous, 3-stand, 2,300-mm mill at Chelyabinsk (1961), and two continuous 1,700-mm mills -- one a 6-stand mill at the Cherepovets plant and the other an 11-stand mill at the Ilyich-Zhdanov plant (1960). A 1,700-mm mill was planned to be in operation at Chelyabinsk in the third quarter of 1961 but was incomplete at the end of the first quarter of 1962. This mill and the 2,300-mm mill are to be used mainly for producing stainless steel sheet. 100/

Four cold rolling mills have been installed. One, a carryover from the previous year, was commissioned in 1959 at the Asha Iron and Steel Works. Three cold strip mills have been installed -- a 5-stand, 4-high, 1,200-mm mill at Novo-Lipetsk (1960), a 1,700-mm mill at the Zaporozh'ye Metallurgical Plant (1960), and a cold strip mill at the Leningrad Steel Rolling Mill. Three cold rolled sheet mills and a cold strip mill were scheduled for 1961 but were not completed. Included were a 2,800-mm mill at Zaporozh'ye, 1,700-mm mills at Cherepovets and

\* Spiral-welded pipe is made from sheet of sizes produced in the USSR. The 4,200-mm mill would roll wide plate which would be used in making 1,020-mm pipe on a straight-seam, single-weld basis.

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Ilyich-Zhdanov, and a 2,000-mm cold strip mill (the second section of an electric sheet shop) at Novo-Lipetsk which reportedly was nearing completion in January 1962. 101/

A number of bar, rod, wire, and other mills, including pipe and tube mills, have been commissioned since the beginning of 1959. Although there are shortages of other sizes of pipe, the greatest pressure has been on facilities for producing pipe that is 426 mm and more in diameter -- particularly in the larger sizes, 500 mm and above. Since the plan period began the USSR has commissioned one spiral weld mill designed to produce up to 720-mm pipe; one 820-mm electric weld mill; and, in November 1961 at Novomoskovsk, the industry's only facilities for making 1,020-mm pipe. Another mill for making 1,020-mm pipe is being installed at the Chelyabinsk Pipe Plant and is planned to be completed in 1962, although the equipment reportedly had not been ordered as of January 1962. 102/ Spiral-weld mills capable of making pipe of up to 820-mm diameter are to be installed in 1962 at the Novomoskovsk and Ilyich-Zhdanov plants. 103/

F. Continuous Casting

The Soviet industry has worked intensively for more than a decade on the development of continuous casting facilities. The continuous casting process is designed to permit casting of molten steel directly into billets or slabs, eliminating the pouring of ingots and their reduction in intermediate mills. The advantages, according to Soviet writers, are reductions in metal losses and in the number of workers required, an increase in operating efficiency, lower costs of production, and possibly a reduction in capital requirements. 104/

Industrial-scale equipment has been installed in six plants, and five more installations are planned. Total output is planned at 8 million tons in 1965. 105/ Since the beginning of the plan period, two strands with 90-ton ladles were installed in the electric furnace shops at Novo-Lipetsk. A 4-strand unit -- said to be the largest in the world -- was put in operation at the Donetsk (formerly Stalino) plant. This facility has 140-ton ladles and is operated with the open-hearth furnace shop.

These and other continuous casting facilities in the USSR, although built on a commercial scale, are operated in part on an experimental basis, the entire process still being in the developmental stage. For that reason, if no other, the USSR has no plans as yet for discontinuing the construction of blooming and slabbing mills. Production in 1961 exceeded 700,000 tons and is planned to be about 1 million tons in 1962. 106/

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III. Major Technical Advances

Significant increases in capacities are resulting from the widespread application of technical and operating advances. How much production is being obtained in these ways is unknown, although Soviet estimates claim that output of open-hearth furnaces has increased almost 2 million tons as a result of "technical improvements and the use of new repair methods." 107/ In the 7 years, 1959-65, increased output of existing facilities is planned to account for at least 25 percent of the net increase in production of pig iron, up to 40 percent of the net increase in crude steel, and 25 percent of the net increase in rolled steel (see Table 4\*). The more important of the technical advances are the use of well-prepared raw materials\*\* and auxiliary fuels in blast furnaces, the use of oxygen in blast furnaces and in steelmaking, and the mechanization and automation of operations and processes in the industry -- developments closely paralleling similar trends in the West.

A. Auxiliary Fuels

Supplementary fuel injection practices will be adopted increasingly in the USSR as in the US, although currently they are applied more extensively in the USSR than in the US. The incentives are reductions in consumption of coke, which is a high-cost material in each country although relatively more expensive in the USSR than in the US; the higher rates of production achieved at blast furnaces; and the savings, or at least postponement, of capital investment in coke ovens and blast furnaces. The question is whether, at specific plants, the supplementary fuel will be natural gas (which the Soviet steel industry is emphasizing currently) or oil or pulverized coal or some combination. The answer depends essentially on the relative costs of the various types of fuel and their availability at specific locations.

The use of natural gas as a supplementary fuel in the blast furnace was undertaken in the USSR on an experimental basis in 1957, 108/ and in 1958 this practice was used at 13 blast furnaces which produced 5.1 million tons of pig iron -- 13 percent of the total production of pig iron in that year. The Seven Year Plan provided for converting more than 50 blast furnaces to the use of natural gas, 109/ and most new furnaces are to be equipped for this practice. The use of supplemental fuel injection practices in blast furnaces has been greatly extended since the plan period began. By the end of 1960, 46 furnaces with a total output of pig iron in that year of 19.3 million tons (41 percent of Soviet production) had been converted, 110/ and in mid-1961 it was reported that

\* P. 14, above.

\*\* See II, B, p. 9, above.

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53 blast furnaces had been or were about to be converted. 111/ Furnaces using natural gas were to produce about 29 million tons of pig iron in 1961 (56.6 percent of the total), according to the plan. 112/

B. Oxygen in Steelmaking

The extension of oxygen injection practices in steelmaking and, although to a lesser extent, in blast furnace operations\* is one of the most important developments envisaged for the Soviet steel industry during 1959-65. One Soviet estimate is that output of open-hearth furnaces in operation in 1958 could be increased 8 million tons a year by adopting oxygen injection practices. 115/

In the original plan for 1959-65 the total production of steel in oxygen-fed furnaces is to increase from 24 percent of the steel produced in 1958 to 70 percent in 1965 116/ -- or from 13 million to 64 million tons, based on production of 91 million tons of steel, which was the original goal for 1965. If it remains the objective to make 70 percent of the steel in oxygen-fed furnaces, the revision in the production plan would raise the amount to be made with the use of oxygen to 67 million tons in 1965.

The plan provides for installing a number of new, basic oxygen converters; converting Bessemer furnaces to top blown oxygen units; and greatly extending the use of oxygen in open-hearth and electric furnaces. All open-hearth and electric furnaces at major plants are to be equipped for oxygen injection by the end of 1965. 117/ Consumption of oxygen, per ton of steel, in 1965 is planned at 35 cu m for open hearths, 55 cu m for converters, and 15 to 20 cu m for electric furnaces. 118/

The magnitude of the over-all program and the importance assigned to it by Soviet planners are shown by the fact that more than 100 million rubles are to be invested in oxygen-generating facilities for the ferrous metals industry. 119/ Where oxygen will be used in blast furnaces and in steelmaking, steel plants are to be equipped with oxygen plants having capacities of 12,500 cu m per hour or 35,000 cu m per hour. 120/ A total of 30 oxygen stations of these sizes is planned for 1959-65 121/; the

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\* The application of this practice, as planned, to all blast furnaces in operation in 1958 could increase their production by 3 million tons a year, according to Soviet estimates. 113/ The combined use of oxygen - natural gas injection practices would increase production of pig iron by 15 million tons and would reduce consumption of coke by a comparable amount. 114/

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number of each size is unknown. Smaller units, with a capacity of 5,000 cu m per hour, also will be installed in steel plants.\*

The evidence indicates, however, that production of steel with the use of oxygen is not increasing at the rate planned. To increase output of oxygen-fed furnaces from 13 million tons in 1958 to 67 million tons in 1965, as planned, would require an average annual increase of about 26 percent. On this basis, production of 18.4 million tons in 1960 123/ was 2.4 million tons less than would be expected.

The lag in 1959-60 apparently resulted mainly from the failure to increase production of steel in oxygen-fed open-hearth and Bessemer furnaces as rapidly as planned. Production of basic oxygen converter steel in 1960 was 2.5 million tons, 124/ which was slightly more than would be required (2.1 million tons), assuming the average annual rate of increase of about 35 percent indicated by the plan to raise production to 9.6 million tons\*\* in 1965. Production of steel in Bessemer converters, all of which reportedly have been converted to top blown oxygen units, was about 800,000 tons less than the 2.7 million tons that would be required by the planned rate of increase in 1959-65. It can be inferred from these estimates that production of oxygen-fed open-hearth steel was behind the plan by as much as 1.8 million tons in 1960. At that time, only 8 open-hearth shops with perhaps no more than 50 furnaces were equipped to use oxygen. 126/

The results achieved in 1961 are not yet available. Data for the first 9 months, however, indicate that production of basic oxygen converter steel was no larger than in 1960 -- 2.5 million tons -- compared with an estimated planned output of 2.9 million. Production of Bessemer furnace steel may have increased slightly but was perhaps 1.5 million tons less than the plan.

The lag in the oxygen steelmaking plan\*\*\* reflects, essentially, delays in designing, producing, and installing oxygen-generating equipment. The failure to install new basic oxygen converter capacity during 1959-60 apparently did not affect the rate of increase in output in those years but became a retarding factor in 1961. New converter capacity that is being built is not expected to be in production until 1963. Yet, by that time, production of steel in basic converters should approximate 5.3 million tons (more than double the level of 1961) in order to recover the rate of growth required to meet the plan for 1965. Achievement of

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\* Units producing 12,500 cu m per hour are the BR-1 units, those with a capacity of 35,000 cu m per hour are BR-2 units, and the 5,000 cu m per hour units are designated BR-5. 122/

\*\* Basic oxygen converter steel is now planned to be 10 percent of the total in 1965. 125/

\*\*\* See II, D, pp. 13 ff.

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the planned objectives is unlikely in view of the relatively slow progress being made toward eliminating the sources of delays in developing new capacity. Failure to accomplish the plans, however, would not prevent the total steel production from reaching the level planned for 1965, although it could jeopardize plans for retiring obsolete steelmaking capacity and for reducing costs of production.

C. Automation and Mechanization

Plans for developing and applying modern methods of mechanized materials handling and devices and systems for automatically performing or controlling operations and processes in the steel industry are stated largely in general terms in available reports. During 1959-65 the industry plans to "automate" 114 blast furnaces, 177 open-hearth furnaces, and 45 rolling mills. 127/ What are described as "complex systems for regulating the blast furnace processes" reportedly are to be installed on 33 new blast furnaces and on almost all blast furnaces to be reconstructed during 1959-65. 128/ The "level of mechanization and automation" in ferrous metallurgy is to be raised to 80 percent by 1965. 129/ Specific operations at many plants will be equipped with automatic controls during the 7-year period. Six plants, however, have been designated for special efforts in this respect and are to be made into "model" plants as regards automation and mechanization -- the Kuznetsk, Magnitogorsk, Nizhniy Tagil, and Dzerzhinsk steel plants, the Bagley coke-chemical plant, and the Zaporozh'ye refractories plant. 130/

The USSR is heavily committed to the program for increased mechanization and automation in the steel industry. Capital outlays for the program for ferrous metallurgy as a whole during 1959-65 reportedly are planned at 370 million rubles. 131/ The larger share of this investment undoubtedly is intended for equipment to improve materials handling -- that is, for mechanization -- which, in the ferrous metals industry generally, is considerably less advanced than in the US. The low level of mechanization in fact partly explains the lag in developing and applying automatic controls. "Until the problem of mechanization has been solved, it is practically impossible to start work on automation." 132/

Assessment of progress to date is made difficult by the lack of sufficient detailed information to evaluate specific, claimed advances. Soviet reports of applications of "automation" to specific production units frequently prove to refer only to more advanced instrumentation or, in some instances, to mechanization of an operation. Apparently, more progress has been made in automation and mechanization in the blast furnace and steelmaking segments than in the rolling and finishing segment of the industry. In general, however, the program is advancing less rapidly than planned.

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A considerable amount of sophisticated research on basic processes and on instruments and systems for automatic control of processes and operations in the steel industry is being done in research institutes and plant laboratories as shown by reports in technical literature and by reports of Western visitors to the USSR. Research is being undertaken, for example, on blast furnace and steelmaking processes in an effort to develop data required to construct mathematical models essential to the development of computer control of these processes. Similar research is being done in the US.

Computers reportedly have been installed in several Soviet plants, mainly for experimental work on the problem of adapting computers to blast furnaces and steelmaking units. Soviet claims concerning some computer-controlled operations have proved to be exaggerated, however. Western visitors to Novo-Lipetsk in 1961, for example, found "no automation on blast furnaces [although they] had learned in 1959 that at least one furnace was, or would be in 1960, computer controlled. In fact, no such arrangement exists and none of the personnel was aware of any such plans." 133/ Reports that a converter at Krivoy Rog was computer-controlled also proved to be unfounded. "The converter practice at Krivoy Rog is completely conventional and, if anything, is well behind the degree of automatic control presently achieved at ... [one US plant]." 134/ Concerning automation of blast furnaces at Krivoy Rog, including one described by the USSR as the world's most highly automated, these observers report that the furnaces are "fairly well instrumented but nothing in advance of good American practice." 135/ Regarding plans for computer control of blast furnaces at Krivoy Rog, the system being worked on was described as a "simpler approach than is presently contemplated in the US and one which can hardly be regarded as complete computer control." 136/

At the plants to be made into "model" plants during the plan period, a number of specific operations have been mechanized and automatic controls adapted to some. The program is behind schedule, however, at least at some of the plants. At the Nizhniy Tagil plant it is lagging about 1 year. 137/ The Dzerzhinsk plant is 2 years behind its plan, 138/ and the program for Magnitogorsk apparently was not accomplished in 1961.

#### IV. Steel Mill Products

The plan for production of major categories of steel mill products in 1959-65 is indicated by data in Table 6.\* Major emphasis is on expanding output of flat rolled products and pipe and tube -- particularly, in the former category, production of cold rolled sheet and end products

\* Table 6 follows on p. 27.

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Table 6

Production of Selected Steel Mill Products in the USSR  
 1958-61 and Planned for 1965

Product	Thousand Metric Tons				
	1958	1959 <sup>a/</sup>	1960 <sup>a/</sup>	1961 <sup>b/</sup>	1965 Plan
Rails <sup>c/</sup>	1,837 <sup>d/</sup>	N.A.	N.A.	N.A.	2,700 <sup>d/</sup>
Heavy sections	8,653 <sup>e/</sup>	N.A.	N.A.	N.A.	13,625 <sup>e/</sup>
Light sections	2,900 <sup>d/</sup>	N.A.	N.A.	N.A.	4,400 <sup>d/</sup>
Wire rods	2,934 <sup>d/</sup>	3,180	3,547	3,800	5,480 <sup>d/</sup>
Strip, hot rolled	2,041 <sup>a/</sup>	2,093	2,756	3,200	N.A.
Plate	6,490 <sup>d/</sup>	N.A.	N.A.	N.A.	13,690 <sup>d/</sup>
Sheet, hot rolled	4,853 <sup>d/</sup>	N.A.	N.A.	N.A.	12,660 <sup>d/</sup>
Selected end products					
Cold rolled sheet	1,171 <sup>d/</sup>	1,390	1,533	1,700	6,450 <sup>d/</sup>
Cold rolled strip	329 <sup>f/</sup>	N.A.	N.A.	N.A.	510 <sup>f/</sup>
Electrical sheet	388 <sup>a/</sup>	463	494	600	930 <sup>g/</sup>
Transformer sheet	25 <sup>h/</sup>	N.A.	N.A.	N.A.	268 <sup>h/</sup>
Tinplate	269 <sup>d/</sup>	304	312	330	600 <sup>d/</sup>
Of which:					
Electrolytic	13 <sup>i/</sup>	N.A.	N.A.	N.A.	342 <sup>i/</sup>
Total pipe	4,623 <sup>j/</sup>	5,215	5,805	6,400	10,210 <sup>j/</sup>
Seamless pipe	2,737 <sup>j/</sup>	N.A.	3,266	3,400	5,008 <sup>j/</sup>
Welded pipe	1,886 <sup>j/</sup>	N.A.	2,539	3,000	5,202 <sup>j/</sup>
Electric welded (under 426 mm)	357 <sup>j/</sup>	N.A.	N.A.	N.A.	1,238 <sup>j/</sup>
Electric welded (426 mm and above)	862 <sup>j/</sup>	N.A.	N.A.	N.A.	2,400 <sup>j/</sup>
Furnace welded	667 <sup>j/</sup>	N.A.	N.A.	N.A.	1,564 <sup>j/</sup>

a. 139/

b. Estimated on the basis of production for 9 months as given in source 140/.

c. For broad-gauge track.

d. 141/

e. Estimated on the basis of source 142/.

f. 143/

g. Estimated on the basis of a 140-percent increase during 1959-65. 144/

h. 145/

i. Production in 1958 was 5 percent of the total amount of tinplate produced and in 1965 is planned to be 57 percent. 146/

j. 147/



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such as transformer and electrical sheet, which are in short supply. Large increases in production of electric welded pipe are planned in order to meet the expanded requirements of the oil and gas industries.

In addition to increased tonnages of the total output of rolled steel, a wider assortment and improved quality of steel mill products are major objectives of the Soviet steel industry. The relatively limited range of the products produced in the USSR is indicated by the fact that only about 600 standard sizes are available, 148/ whereas the US industry, oriented to consumers' requirements, produces several thousand.

Plans for improving the quality of steel mill products involve a number of considerations, one of which is the increased production of low-alloy steel in order to expand output of lighter weight, high-strength steel mill products and thus to reduce the volume of steel required in specific applications without loss of performance characteristics. Production of low-alloy steel is planned to increase from 1.35 million tons in 1958 to 6 million tons in 1965. Substantial increases also are planned for production of stainless and other alloy steels, but the rates or amounts of increase are unknown. The effort being made to improve the quality of products also is indicated by the emphasis being given to the installation of heat treating facilities and cold rolling mills.

Annual plans for the total production of rolled steel in 1959-61 were fulfilled, and planned increases in output of at least some main categories of products were achieved. Production of cold rolled sheet in 1961, for example, was approximately 1.7 million tons, about the amount planned for that year.\* Similarly, the total production of pipe has increased at about the rates planned. There is considerable evidence, however, that production goals within these and other broad categories are not being achieved and that such disparities -- between the accomplishment of over-all objectives as compared with goals for specific products -- may well characterize the trend in production of rolled steel during the remainder of the plan period.

The variety of steel mill products apparently is not increasing as rapidly as planned. A Soviet technical journal, reviewing progress in the steel industry in 1959-60, noted that there was an increase of 80 in the number of rolled shapes being produced but that increases were "being accomplished all too slowly." 150/ A similar criticism was expressed in September 1961 by a spokesman for the State Committee on Automation and Machine Building of the Council of Ministers, USSR, who also was highly

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\* An increase of 42 percent above 1958 was planned. 149/

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critical of the quality of steel supplied to the machine building industry. 151/ Complaints appeared in the Soviet press in January 1962 concerning deficiencies in supplies and in the quality of large-diameter pipe. 152/

The installation of additional rolling mills and other facilities planned for 1959-65 should alleviate but will not necessarily solve the steel industry's problems in providing steel mill products that satisfy consumers' requirements. To a large extent these problems originate in basic concepts of the centralized planning system. Production in the steel industry is planned in physical terms -- that is, tons of rolled steel or tons of cold rolled sheet -- rather than in terms of products of specific grades with specified tolerances and performance characteristics. This concept, which is designed to assure the availability of a sufficient tonnage of steel mill products to meet rapidly increasing requirements, had more validity in early stages of Soviet economic development than it has now or will have in the future. Because it provides rewards for tons of output rather than for quality and variety of output, this concept has become increasingly inadequate to assure supplies of steel that meet the more demanding requirements of steel-consuming industries.

State standards for steel mill products could be modified to meet consumers' requirements, and such revisions are being made. The pricing system for steel mill products could be revised to widen the application of extra charges for products meeting specifications above those for standard products. Neither of these approaches is likely to solve the problem, however, unless at the same time the planning of production is altered to provide incentives for quality and variety as well as for tons of output. Such changes in planning may well be forced in the future by the cost, to the economy, of continuing a method of planning that is wasteful of materials, manpower, and capital.

V. Foreign Trade

During the first half of the Seven Year Plan, Soviet foreign trade in ferrous metallurgical raw materials and products followed essentially the same pattern as in prior years. The USSR continued to be a net exporter of raw materials and rolled steel to the European Satellites, a net exporter of rolled steel to Communist Asia, and a net importer of rolled steel from the industrial West. Exports and imports of principal commodities are shown in Table 7.\* The geographic distribution of trade in rolled steel is shown in Table 8.\*\*

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\* Table 7 follows on p. 30.

\*\* Table 8 follows on p. 31.

Table 7

Estimated Exports and Imports of Raw Materials and Products  
 by the Ferrous Metallurgical Industry in the USSR a/  
 1955-60

Commodity	Thousand Metric Tons							
	1955-57 <u>b/</u>		1958		1959		1960	
	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports
Iron ore	9,752	0	11,919	0	13,446	0	15,182	0
Manganese ore	858	0	833	0	979	0	973	0
Chromite	212	0	215	0	272	0	427	0
Nickel <u>c/</u>	5.3	Negl.	5.8	Negl.	6.1	4.6	6.3	8.2
Molybdenum <u>c/</u>	N.A.	1.1	N.A.	2.6	N.A.	2.8	N.A.	3.0
Tungsten <u>c/</u>	Negl.	22	0.7	28	0.7	30	2.2	30
Cobalt	0.137	N.A.	0.209	N.A.	0.199	N.A.	0.217	N.A.
Ferroalloys	100	4	110	5	131	2	155	13
Coke <u>d/</u>	1,457	5	1,739	0	1,836	0	1,988	0
Pig iron	1,262	411	1,046	160	1,433	138	1,801	208
Steel mill products	2,002	613	2,411	949	2,696	1,200	2,996	1,531

a. Source 153/ unless otherwise indicated.

b. Average per year.

c. Estimated.

d. Excluding the following amounts of Polish coke shipped to East Germany on the Soviet account (appearing in Soviet import and export statistics): average for 1955-57, 469,000 tons; for 1958, 678,000 tons; for 1959, 630,000 tons; and for 1960, 658,000 tons.

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Table 8

Exports and Imports of Steel Mill Products  
by the USSR, by Geographic Area a/  
1955-60

Area	Thousand Metric Tons							
	1955-57 b/		1958		1959		1960	
	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports
Sino-Soviet Bloc								
European Satellites	1,121	169	1,679	215	1,947	311	2,229	356
Communist Asia	386	30	281	67	224	13	235	26
Total Bloc	<u>1,507</u>	<u>199</u>	<u>1,960</u>	<u>282</u>	<u>2,171</u>	<u>324</u>	<u>2,464</u>	<u>382</u>
Industrial West	123	406	89	662	140	854	162	1,099
Underdeveloped areas	324	0	336	0	344	0	307	0
Unknown	48	8	26	5	41	22	63	50
Total	<u>2,002</u>	<u>613</u>	<u>2,411</u>	<u>949</u>	<u>2,696</u>	<u>1,200</u>	<u>2,996</u>	<u>1,531</u>

a. 154/

b. Average per year.

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Soviet imports of pipe have increased substantially, particularly imports of large-diameter welded pipe and other pipe required by the petroleum and natural gas industries, as indicated in Table 9.\* Most of the large-diameter pipe imported in 1959-61 was 1,020-mm pipe for major Soviet pipelines which the USSR, until near the end of 1961, did not produce. The principal supplier was West Germany, whose shipments to the USSR amounted to about 480,000 tons in 1959-61. The USSR contracted for 240,000 tons of 1,020-mm pipe from Italy to be delivered during 1961-63, of which 30,000 tons were to have been shipped in 1961. The USSR also has a contract to purchase 135,000 tons of this size pipe from producers in Sweden, with deliveries to be made in 1961-64.

Continued access to Western supplies of 1,020-mm pipe would minimize for the USSR the adverse effects of delays in developing domestic capacity to produce this pipe, thus facilitating the construction of pipelines requiring 1,020-mm pipe in spite of the inadequacy of Soviet pipe-making capacity. The ability to import other sizes of large-diameter pipe from the West affords the USSR an opportunity to obtain optimum utilization of its pipe mill capacity, inasmuch as facilities capable of making 820-mm pipe, for example, also must be used to make pipe of smaller diameters.

Late in 1961 the USSR contracted with firms in Western Europe to further process semifinished products shipped to Western mills from the USSR. Almost 200,000 tons of hot rolled coils were to be re-rolled into cold rolled sheet at mills in the UK 155/ and 200,000 tons at mills in West Germany, 156/ with deliveries to the USSR scheduled for 1962. In addition, the USSR contracted to supply billets, valued at \$2 million, to be rolled into bars and wire rods, half to be procured in West Germany and the remainder elsewhere in Western Europe. 157/ These transactions would involve heavy transportation costs and, depending on the provisions of the contracts, could be relatively expensive for the USSR. Aside from the costs involved, they reflect the lag in developing rolling capacity in the USSR.

The USSR began importing nickel from Free World sources in 1959 following the relaxation of COCOM controls, such imports totaling about 16,000 tons in 1959-61. The principal sources were France and Canada. Purchases from Canada were discontinued at the end of 1961, the cancellation coinciding with the availability of nickel oxide produced at properties in Cuba formerly owned by the US. It is estimated that possibly as much as 9,000 tons or more of nickel (metallic content) were obtained from Cuba in 1961.

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\* Table 9 follows on p. 33.

Table 9  
 Exports and Imports of Steel Mill Products by the USSR a/  
 1955-60

Product	Thousand Metric Tons							
	1955-57 <sup>b/</sup>		1958		1959		1960	
	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports
Rails	150	11	187	0	201	0	204	0
Rail accessories	63	3	35	0	50	0	44	0
Beams, channels, and piling	144	0	126	0	137	0	103	0
Structurals, sections	338	165	422	268	460	261	502	293
Structurals, construction steel	89	90	92	210	130	191	125	260
Sheet and plate	590	114	728	209	714	162	865	276
Tool steel and sectional steel	3	2	4	2	4	2	4	5
Stainless steel sheet and sections	3	0	4	1	5	17	6	15
Dynamo steel	6	7	9	17	8	18	10	22
Transformer steel	6	6	8	27	8	26	10	41
Galvanized sheet	10	10	10	7	14	0	17	0
Tinplate	15	N.A.	19	N.A.	27	N.A.	40	N.A.
Wire rods	59	52	55	49	66	16	86	23
Oil line pipe	100	38	106	73	96	163	89	186
Welded pipe (large diameter)	7	71	22	80	24	249	18	266
Rolled pipe	42	13	36	2	36	48	40	58
All other pipe and tube <sup>c/</sup>	50	8	51	2	56	40	58	69
All other steel mill products	327	23	497	2	660	7	775	17
Total	<u>2,002</u>	<u>613</u>	<u>2,411</u>	<u>949</u>	<u>2,696</u>	<u>1,200</u>	<u>2,996</u>	<u>1,531</u>

a. 158/

b. Average per year.

c. Including the following exports and imports of thin-walled pipe (in thousand meters): for exports, the average per year in 1955-57 was 1,449; in 1958, 1,082; in 1959, 2,025; and in 1960, 2,928, and for imports, the average per year in 1955-57 was 2,512; in 1958, 1,000; in 1959, 13,500; and in 1960, 24,800.

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