JOINT ARMY-NAVY
INTELLIGENCE STUDY

EUROPEAN U.S.S.R.

RESOURCES AND TRADE

This document contains information affecting the national defense of the United States within the meaning of the Espionage Act, 50 U.S.C., 31 and 32, as amended. Its transmission or the revelation of its contents in any manner to an unauthorized person is prohibited by law.

LIST OF EFFECTIVE PAGES, CHAPTER IX

Subject Matter	Change in Effect	Page Numbers
Cover Page	Original	unnumbered
List of Effective Pages and Table of Contents, Chapter IX (inside front cover)	Original	unnumbered
Text	Original	pp. IX-1 to IX-4
Figures (inserts, reverse sides blank)	Original	Figures IX-1 to IX-3
Text	Original	pp. IX-5 to IX-10
Figure (insert, reverse blank)	Original	Figure IX-4
Text	Original	pp. IX-11 to IX-14
Figure (insert, reverse blank)	Original	Figure IX-5
Text	Original	pp. IX-15 and IX-16
Figure (insert, reverse blank)	Original	Figure IX-6
Text	Original	pp. IX-17 to IX-28
Figures (inserts, reverse sides blank)	Original	Figures IX-7 and IX-8
Text and Figures	Original	pp. IX-29 to IX-104
Figure (insert, reverse blank)	Original	Figure IX-42
Text and Figures	Original	pp. IX-105 to IX-144
Figures (inserts, reverse sides blank)	Original	Figures IX-53 to IX-66
Table of Contents, continued, and Imprint (inside back cover, reverse blank)	Original	unnumbered

TABLE OF CONTENTS

Note: This chapter is based on data available in Washington, D.C. on the following dates:
Topics 90 to 92: 1 March 1947 Topic 96: 1 January 1948
Topics 93 to 95: 1 January 1947 Topics 97 to 98: 1 April 1947

	Page
90. INTRODUCTION	IX - 1
91. AGRICULTURE	IX - 1
A. Natural environment	IX - 1
(1) Soils	IX - 1
(2) Climate	IX - 2
B. Farm system and land tenure	IX - 2
(1) Kolkhozy	IX - 3
(2) Machine-tractor stations	IX - 4
(3) Sovkhozy	IX - 6
C. Farm practices	IX - 6
D. Fertilizers	IX - 7
(1) Manure	IX - 7
(2) Commercial fertilizer	IX - 8
E. Land utilization	IX - 8
92. FARM PRODUCTS AND FISHING	IX - 9
A. Crops	IX - 9
(1) General crop pattern	IX - 9
(2) Grains	IX - 13
(3) Potatoes	IX - 16
(4) Sugar beets	IX - 16
(5) Sunflower seed	IX - 17
(6) Flax	IX - 17
(7) Hemp	IX - 18
(8) Cotton	IX - 19
(9) Tobacco	IX - 19
B. Livestock	IX - 19
C. Food consumption and distribution	IX - 20
(1) Consumption	IX - 20
(2) Distribution system	IX - 21
D. Fisheries	IX - 23
(1) General	IX - 23
(2) Caspian Sea	IX - 24
(3) Sea of Azov	IX - 25
(4) Black Sea	IX - 25
(5) Northern seas	IX - 25
(6) Fresh water	IX - 26
(7) Leningrad District	IX - 26
(8) Lithuanian SSR	IX - 26
(9) Estonian SSR	IX - 26
(10) Latvian SSR	IX - 26
93. WATER RESOURCES	IX - 26
A. General	IX - 26
B. Surface water	IX - 27
(1) Lake region	IX - 27
(2) Humid region	IX - 27
(3) Poles'ye (Pripet Marshes)	IX - 27
(4) Transition zone	IX - 27
(5) Semiarid region	IX - 27
(6) Semideserts	IX - 27
C. Ground water	IX - 27
(1) Surficial sediments	IX - 28
(2) Bedrock	IX - 28
94. CONSTRUCTION MATERIALS	IX - 28
A. General	IX - 28
B. Timber	IX - 29
C. Sand and gravel	IX - 29
D. Building stone	IX - 29

(Table of Contents continued, inside back cover)

Chapter IX

RESOURCES AND TRADE

Prepared under supervision of Intelligence Division, General Staff, U.S. Army, by Geological Survey, Department of the Interior; by Office of Foreign Agricultural Relations, Department of Agriculture; by Engineer Research Section, Army Map Service, Corps of Engineers; by Strategic Branch, Intelligence Division, General Staff, U.S. Army; and by Board of Governors of the Federal Reserve System

90. INTRODUCTION

The economic structure of European USSR is that of the Soviet Union, a highly centralized state characterized by collective ownership of the means of production and by state planning of economic activity. The land, all forms of natural wealth, and almost all means of manufacturing are state property. The economy operates in conformance with comprehensive, periodic plans, prepared by the State Planning Commission *(Gosplan)*, and the various sectors of the economy are under the jurisdiction of Union government ministries whose progressive subdivisions, functional and regional, lead down to the individual *Kombinat* (integrated group of plants), plant, farm, store, or other economic unit.

Soviet officials, in announcing the fourth Five-Year Plan, for the period 1946-1950, stated that the over-all economic objective of the USSR is to increase its military-economic potential to such a degree that the country will be safe in the future against "any contingencies." Heavy industry receives the major emphasis, and the goal appears to be the attainment by 1970 of the aggregate heavy industry output level reached by the United States in 1939.

In this Soviet economic pattern, European USSR has a key role. The area includes by far the bulk of the Soviet Union's population, has the most extensive industrial development, and is the transportation and communications hub.

European USSR, with a crop area of 250 million acres, is normally self-sufficient in most foodstuffs, and before World War II produced small surpluses. Agriculture employs over half of the area's population.

Natural supplies of surface or ground water are plentiful in all parts of the area except in the extreme south and southeast; in the central and northern parts there is a close network of perennial streams, and in the northwest lakes are numerous. Construction materials are abundant. Timber is found in the northern and central parts of the region; sand and gravel are widely distributed as surficial deposits; building stone, crushed rock, and cement materials are generally available.

Iron reserves of European USSR are estimated at approximately 5 billion metric tons, or 45% of the total of the Soviet Union. The area's manganese accounts for nearly half of the total annual production of the USSR; reserves are estimated to exceed 400 million tons. Coal production reached 96 million tons in 1940, and reserves are approximately 10% of the Soviet Union's total. The petroleum resources of European USSR, however, amount only to about 2.5% of total USSR reserves.

The area's electric power capacity at the end of 1946 totaled approximately 9.5 million kilowatts, estimated to be more than 70% of total Soviet installed capacity.

Sixty-five percent of prewar Soviet industry was located in European USSR. War damage and removals resulted in the loss of approximately 40% of the area's industry. While there has been a major trend toward development of industrial capacity eastward beyond the Urals, much war-shifted capacity has been reestablished in European USSR and in 1946 the bulk of capital construction took place in this area.

91. AGRICULTURE

With a crop area of over 250 million acres and more than half of its population engaged in agriculture, European USSR not only leads all European countries, in agriculture, but is one of the foremost agricultural areas of the world. Although considerable industrial development has taken place, especially in European USSR proper*, agriculture continues to be the backbone of economic life in this area.

A. Natural environment

Soils and climate are the important natural factors which, in interaction with social and economic institutions, condition the agricultural pattern of European USSR.

(1) Soils

While a detailed soil map of European USSR would show a considerable diversity of soils, this area can be divided into two fairly well defined geographical zones, or belts: the nonblack-soil belt and the black-soil belt. The

* The larger part of European USSR, which was within the Soviet frontiers at the end of 1938, is called here "European USSR proper" as distinguished from the territories acquired since the beginning of World War II, termed "newly incorporated" or "acquired territories." These include territories acquired from Finland, Poland, Rumania, and the three Baltic Republics: Lithuania, Latvia, and Estonia.

belt of relatively infertile, leached podzol, or nonblack soils, extends over the wooded northern and north-central parts of the country, and merges in the extreme north into the tundra. The much more fertile belt of chernozem, or black soils, which are rich in humus, extends south of the nonblack-soil area, over the forest-steppe and steppes of the Central Agricultural, Middle and Lower Volga, and the Southern regions, merging in the east and extreme south into the soils of the dry steppes (FIGURE IX-4).

The nonblack soils account for 71% and the black soil for 26% of the total area of European USSR proper. The proportion of the nonblack-soil area would be even larger if estimates were available for the newly incorporated regions, as their soils are predominantly podzolic except in Bessarabia where there is a considerable area of black soils. Although the black-soil belt is much smaller in size than the nonblack-soil belt, it has been agriculturally more important because of its greater fertility. It forms, in fact, the chief natural foundation on which Russian agrarian economy has developed.

The distinction between the two soil belts is so important that it has long served as a basis for a broad economic regional division of the country. The black-soil belt is often called the producing area, for it has been the grain surplus region of the USSR. The nonblack-soil belt on the whole has a grain deficit and is called the consuming area. Nevertheless, with the proper use of fertilizers, and, in some cases, with proper drainage, a large part of the nonblack-soil belt is well suited for agricultural production; except for climate, it is as well suited as the inferior soils of Denmark and Germany. Because of adequate precipitation, crop yields fluctuate less from year to year in the nonblack-soil belt than in much of the more fertile black-soil area, a considerable part of which suffers from recurrent droughts. The nonblack-soil belt is particularly well suited to the growing of flax for fiber, potatoes, root crops, and hay, and consequently for livestock raising. The latter is essential to produce the manure necessary to maintain the fertility of the soil. A larger proportion of the arable land must therefore be devoted to forage crops and less to food crops in the nonblack-soil regions than in the black-soil area.

(2) Climate

Climate does not give the south a great advantage over the north in agricultural production. In the northern and north-central regions, low temperatures and sometimes excessive moisture hamper agriculture, but in the south, and especially the southeast, moisture deficiency hinders production. In the north, the long daily duration of sunlight during the growing season compensates somewhat for the low temperatures. Even in the south, however, the average frost-free period, which roughly measures the growing season for crops, is short.

In Khar'kov (the Ukraine), for instance, the average frost-free period is 151 days, or only slightly longer than in Duluth, Minnesota. As far south as Rostov-on-Don, it is 184 days, as at Milwaukee, Wisconsin. Only in the extreme south does the frost-free period exceed 200 days. In Yalta, on the southern shore of the Crimea, it reaches 245 days, as at Wilmington, North Carolina.

The frost-free period increases not only from north to south, but also from east to west. Thus Kiev, west and slightly north of Khar'kov, has a frost-free period 21 days longer than Khar'kov. L'vov, in about the same latitude but still further west, has a frost-free period of 186 days. Whereas the frost-free period in Moscow is only 130 days, as in northern North Dakota, in Leningrad it is 160 days and in Rīga 173 days owing in part to the moderating influence of the Baltic Sea.

The data above indicate that the growing season for crops, or the frost-free period, is relatively short in European USSR. The Russian farmers therefore have less time in which to do their field work than the farmers in most farming areas of the United States and Western Europe, and their seasonal load is heavier. This creates the problem of employment during the long period not suitable for field work.

The relatively short growing season limits the selection of crops.

Citrus fruits cannot be grown even in southern Crimea, and only the most rapidly maturing varieties of cotton can be grown in southern European USSR, where this crop was introduced on a commercial scale in the 1930's. Even such early varieties of cotton often are injured by fall frosts. With the progress of plant breeding and development of rapidly maturing varieties, the range of crops has grown, and the limits of cultivation are being pushed northward. It has proved possible to grow crops, especially vegetables, even in the arctic region.

More serious than temperature deficiency is the fact that so much of the fertile black-soil area is in the semiarid zone (the boundary of which is indicated on FIGURE IX-4 by the precipitation line of 16 inches (400 millimeters). Here the precipitation is sparse and uncertain from year to year. Moreover, owing to high temperatures, high evaporation during the summer months reduces the moisture supply available to crops. Droughts frequently recur, often aggravated by scorching winds that blow from the deserts of Central Asia and play havoc with growing crops. Harvests are uncertain, especially in the eastern part of this zone where spring wheat, vulnerable to spring and early summer droughts, predominates.

B. Farm system and land tenure

Prior to the 1930's, when agriculture was collectivized, the USSR was characterized by peasant farming of small individual tracts of land. Even before the revolution of 1917 the peasants owned 70% of all land in European Russia, and they leased a considerable portion of the remaining 30% which consisted of large estates. After the revolution, the estate land, with insignificant exceptions, was divided among the peasants who continued to till it on an individual basis but the state kept title to all land, and private ownership of land was legally abolished.

Most of the peasants lived in villages and not on separate farmsteads as in the United States. Cultivated areas were divided into a number of rather narrow strips, and the holding of each peasant family consisted of strips in each field, which were usually intermingled with strips of other families. The strip system in Russia, as in other European countries, was a result of the attempt to equalize holdings with respect to soil, topography, and distance from the village. Over a large part of Russia, such equalization was associated with the communal, repartitional type of land tenure, under which the land commune *(mir)* allotted holdings to its members on some uniform basis with general or partial repartitions of land at regular or irregular intervals. Under an hereditary system of land tenure, which prevailed in the western provinces of Russia, the strips resulted from successive division of holdings among heirs in the process of inheritance.

This scattered strip system of farming, although conducted on an individualistic basis, was usually associated with a common crop rotation, since it was difficult to plant different strips of the same field with crops of vary-

ing growing seasons and maturities, especially since the stubble frequently was used as pasture. Such a system of farming precluded the use of modern power machinery, involved considerable waste of land in boundaries between strips (providing a fertile breeding ground for weeds and pests), and wasted time in traveling from one field to another. During the decade preceding World War I, a strong effort was made by the government to promote consolidation of the scattered strip holdings into a single tract but such consolidated holdings were divided again during the revolution. Another consolidation of scattered holdings, on a much larger scale, occurred in the early thirties when Russian agriculture was collectivized, following a bitter struggle of the Kremlin with the peasants, in the course of which millions were driven off the land and many deported to remote regions.

(1) Kolkhozy

As a result of agricultural collectivization, there were developed two distinct types of Soviet farm units and a separate farm machine service organization: 1) the collective farm or kolkhoz (plural "kolkhozy"), 2) the state farm or sovkhoz (plural "sovkhozy"), and 3) machine-tractor stations or MTS. By far the most important of these is the kolkhoz, which represents the pooling of the holdings of formerly independent peasant farmers operating under tight government control and direction.

Only the land, horses, and other livestock (with some qualifications discussed in Topic 92, B), and the farm machinery are collectivized. The elimination of boundaries transformed the narrow strips into large fields, suitable for modern power machinery, especially in the level steppe country. The peasant families, having thus pooled their holdings, continue to live in their own dwellings in villages. Each village usually comprises the members of one or more kolkhozy, and from these centers the farmers go out every day to work the collective fields.

The state continues to own the land, but each collective farm holds the land it occupies for an unlimited period, "in perpetuity," according to Article VIII of the Soviet Constitution. The title of the kolkhoz to the land is secured by a title deed issued after an official land survey is made.

In addition to their dwellings, each peasant family is entitled, if land is available, to a small plot for a kitchen garden and a small number of personally-owned cattle, hogs, sheep, and goats. But horses, except in nomadic regions, are collective property. A member of a kolkhoz who needs a horse for his own use must borrow it from the kolkhoz.

When their earnings from the kolkhozy were small, the peasants often found it advantageous to work on their little plots and tend their few animals rather than to work in the collective fields, especially if they had the opportunity to sell their produce at good prices on the limited private market in a neighboring town. Kolkhozy members have a legal right to carry on such trade provided they do not use the services of a middleman. In 1937 this personal farming by members of the kolkhozy was estimated to yield over one-fifth of total agricultural production. In 1939 the government decided to limit this type of farming, which competed with collective farming, by fixing a minimum required time for each member to devote to collective work. Members of collective farms, both men and women, who consistently fall below the minimum are liable to expulsion and loss of their plots of land.

The basic law governing the organization, function, rights, and obligations of the kolkhoz is embraced in a model charter approved by the government in 1935. According to the charter, the kolkhoz is a self-governing organization. It elects its officers by majority vote, and manages its own affairs within limits set by government plans and regulations. In practice, however, government officials have been in the habit of appointing, dismissing, and transferring officers of the kolkhozy at will. The government concerns itself directly with problems of seed and forage supply, timely and efficient sowing and harvesting, proper care of livestock, crop rotation, internal organization of the farm unit, and many others. Crop acreages and even yields per acre, and numbers of livestock, are directed by national plans, establishing the goals for republics and provinces. Local goals are set up by republic and province authorities.

The state is a partner in collective farming and has the first claim on production. A kolkhoz must deliver to the government, at low fixed prices, a specified quantity of crops and livestock products per unit of land. The kolkhoz must also pay the state for the field work (plowing, seeding, harvesting) performed by state-owned tractors.

After the obligations to the state are met, seed supplies assembled for the next year's sowing, and other required reserves set up, the remainder is available for distribution by the kolkhoz to its members. The kolkhoz may sell some of its produce to the government at somewhat higher prices than those fixed for compulsory deliveries, and thereby also secure the privilege of purchasing some manufactured products in short supply. It may sell some of its produce on the free private market in the neighboring town at uncontrolled prices, which are usually higher than the prices paid by the state. As no middleman can be legally employed in this process, such trade is limited in scope.

The remainder of the kolkhoz output is distributed in kind among the members, as is the cash income after the necessary expenses of production are met and required appropriations to capital are made. Distribution in kind and in cash is made on a sort of piece-work basis, according to the quantity, skill, and quality of work performed. Work is measured in special units called "labor days." The greater the skill required in a particular task, and the greater the quantity of work done, the larger the payment assessed in terms of "labor days." Bonuses for better quality of work, resulting in higher yields of crops or livestock products, have also been provided in terms of additional "labor days." Inferior quality of work is punishable by reduction in the number of "labor days" assessed. The total number of "labor days" credited to all members of the collective farms are added up at the end of the year, and the income to be distributed, in cash and in kind, is divided by the total number of "labor days."

Each "labor day," therefore, entitles a member of the collective farm to a certain quantity of the product and cash, and, since the number of "labor days" credited to different members of the kolkhoz varies, their earnings also differ. The earnings of individuals and families show considerable variation in the same kolkhoz. There are even greater variations as between different kolkhozy, since the quantities distributed per "labor day" vary from kolkhoz to kolkhoz, depending upon such factors as efficiency of management, fertility of the soil, type of equipment, distance to town markets, and weather conditions, which vary from region to region.

For instance, in 1937, in the Central Agricultural region, 22.2% of all members of the collective farms were credited with 50 or less "labor days," 16.1% from 51 to 100, 25.4% from 101 to 200, 17.8% from 201 to 300, 10.5% from 301 to 400, and 8.0% over 400.

TABLE IX - 1

NUMBER OF COLLECTIVE FARMS (KOLKHOZY) AND HOUSEHOLDS, ALL LAND AND SEEDED AREA PER COLLECTIVE FARM (KOLKHOZ) AND HOUSEHOLD BY REGION, EUROPEAN USSR, 1 JULY 1938

Region	Number of kolkhozy	Number of households per kolkhoz	Total land per kolkhoz*	Total land per household*	Total seeded area per kolkhoz	Total seeded area per household	Percent seeded area to total land per kolkhoz
European USSR proper:			*Acres*	*Acres*	*Acres*	*Acres*	
North	9, 722	47	2, 523	57	381	8	15. 1
Northwest	32, 501	37	1, 305	37	405	11	31. 0
Central Industrial	34, 146	56	1, 324	25	640	11	48. 3
Central Agricultural	23, 041	94	2, 293	25	1, 280	14	55. 8
Upper Volga	21, 828	52	1, 576	32	835	16	53. 0
Middle and Lower Volga	7, 003	136	10, 272	82	4, 090	30	39. 8
South	30, 436	138	3, 517	25	2, 098	15	59. 7
West	9, 665	74	1, 977	27	726	10	36. 7
All European USSR proper	168, 342	76	2, 354	31	1, 105	15	46. 9

* Data as of 1 January 1938.

In the same Central Agricultural region, the average amount of grain, which is the most important product, distributed per "labor day" was four kilograms, or about nine pounds. But, in 24% of kolkhozy it exceeded 11 pounds.

For purposes of labor management, the members of a kolkhoz usually are divided into so-called brigades, each including 40 to 60 workers under a foreman. A definite area of land to be cultivated or a certain number of livestock to be tended is assigned to each brigade. For crops such as sugar beets or cotton, which require much intensive labor, a brigade is further subdivided into smaller units, called *zveno.*

On 1 July 1938 there were over 168,000 kolkhozy in European SSR (TABLE IX-1). The size of the kolkhozy, both in population and in seeded area (FIGURE IX-1), varies from region to region.

The number of peasant households or families in a kolkhoz, and the seeded area per household, are small in the more northern regions. These regions are not densely populated, their villages have always been small, and a considerable area of their land is under forests and permanent meadows or is not suitable for agricultural purposes.

The much more densely populated Central Agricultural region and much of the Ukraine (south) has large collective farms measured in the number of households, but the acreage seeded per household is relatively small. The Middle and Lower Volga region has a large number of households per kolkhoz and the largest acreage seeded per household. However, much of this region is in the semiarid zone of low and variable crop yields which to some extent offsets the larger acreage. In 1938 the kolkhozy accounted for 86.2% of the crop area, varying from 83% in the south to 92% in the Upper Volga region (TABLE IX-2 and FIGURE IX-2).

(2) Machine-tractor stations

Tractors, combines, and other important farm implements are not owned by the kolkhozy, but by state machine-tractor stations, which supply the necessary power machinery and operators to the kolkhozy on the basis of annual agreements. For their services the machine-tractor stations are paid in kind by the kolkhozy at specified rates per hectare (2.471 acres). These rates vary with the officially determined crop yields in a district.

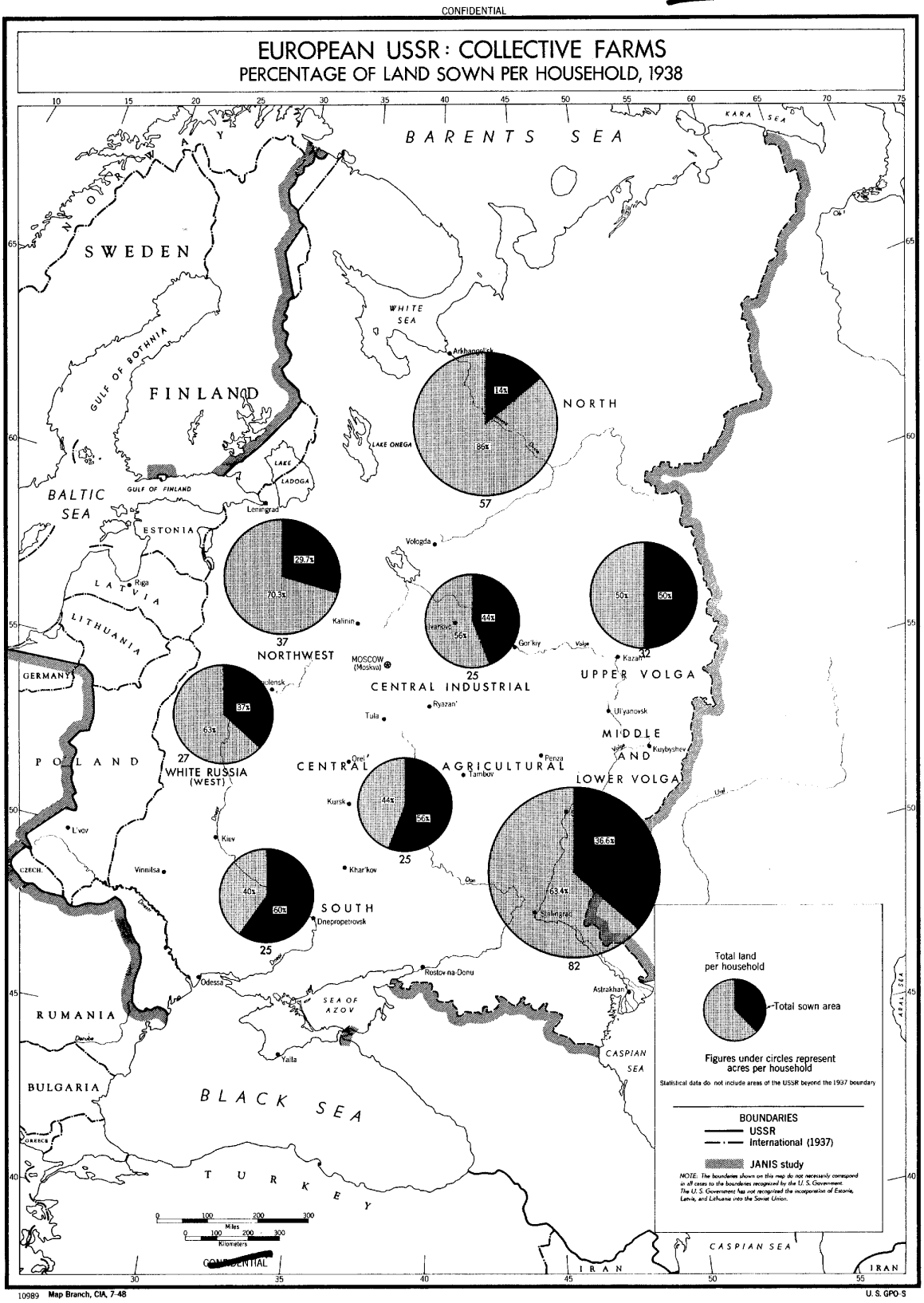
The machine-tractor stations usually have repair shops for tractors and combines, and also staffs of mechanics, agronomists, and officials to provide technical assistance and direction of the kolkhozy. Tractor drivers are paid by the kolkhozy on the basis of "labor days" earned, as are other collective farmers, except that minimum amounts of grain and cash per "labor day" are prescribed by law. Combine operators are paid by the machine-tractor stations.

TABLE IX - 2

SOWN AREA BY TYPES OF FARMS, EUROPEAN USSR, 1938

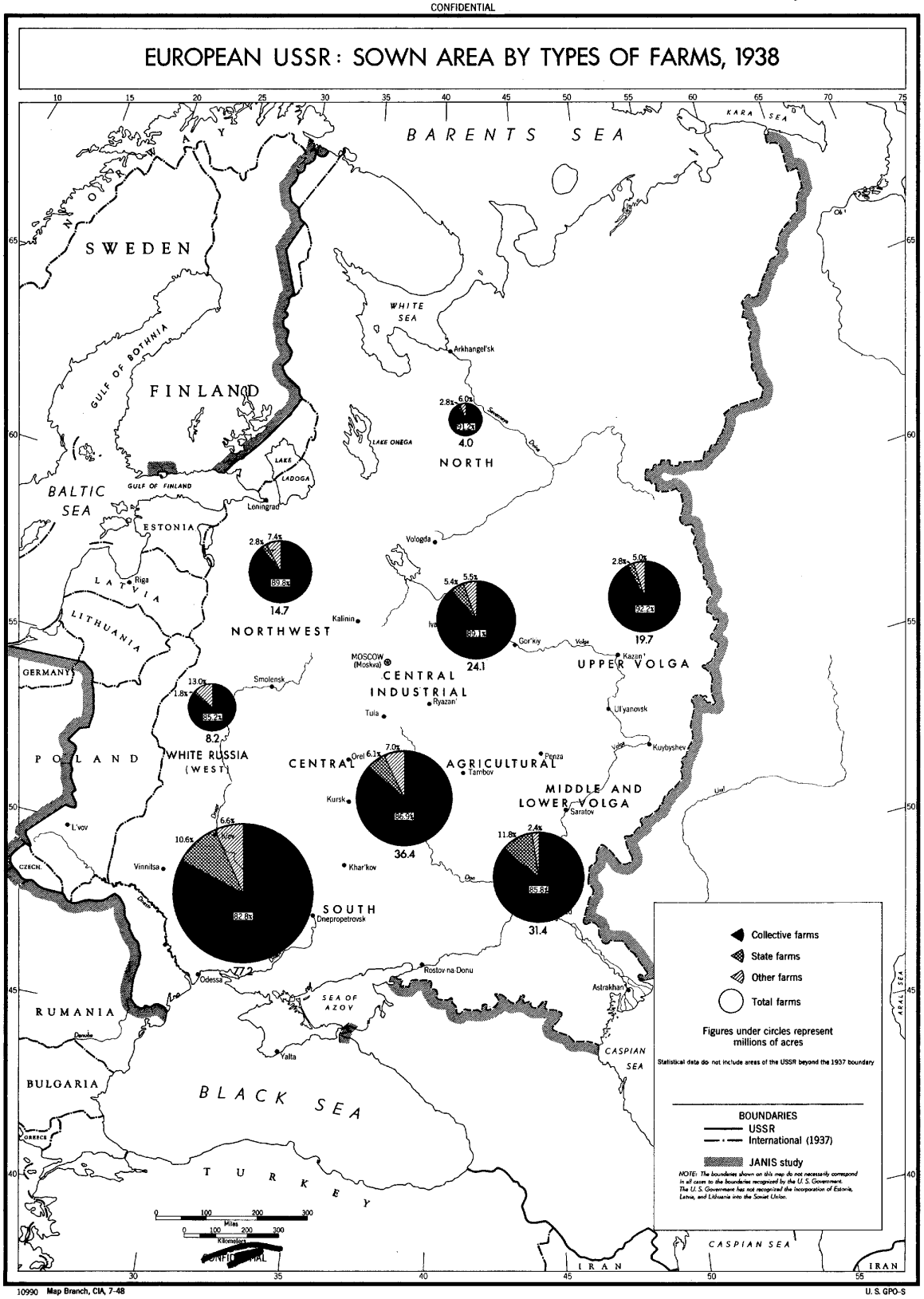
Regions	Collective farms	State farms	Other farms	All farms	Percent of total sown area			
					Collective farms	State farms	Other farms	All farms
	1,000 acres	*1,000 acres*	*1,000 acres*	*1,000 acres*				
European USSR proper:								
North	3, 688. 0	111. 2	244. 6	4, 043. 8	91. 2	2. 8	6. 0	100. 0
Northwest	13, 176. 4	410. 9	1, 092. 4	14, 679. 7	89. 8	2. 8	7. 4	100. 0
Central Industrial	21, 428. 0	1, 306. 7	1, 318. 3	24, 053. 0	89. 1	5. 4	5. 5	100. 0
Central Agricultural	31, 660. 7	2, 216. 7	2, 548. 4	36, 425. 8	86. 9	6. 1	7. 0	100. 0
Upper Volga	18, 208. 3	545. 1	990. 9	19, 744. 3	92. 2	2. 8	5. 0	100. 0
Middle and Lower Volga	26, 935. 6	3, 716. 4	751. 9	31, 403. 9	85. 8	11. 8	2. 4	100. 0
South	63, 865. 5	8, 210. 4	5, 086. 0	77, 161. 9	82. 8	10. 6	6. 6	100. 0
West	7, 026. 0	150. 0	1, 069. 2	8, 245. 2	85. 2	1. 8	13. 0	100. 0
All European USSR proper	185, 988. 5	16, 667. 4	13, 101. 7	215, 757. 6	86. 2	7. 7	6. 1	100. 0

FIGURE IX-1
LAND SOWN, COLLECTIVE FARMS, 1938
JANIS 40
~~CONFIDENTIAL~~



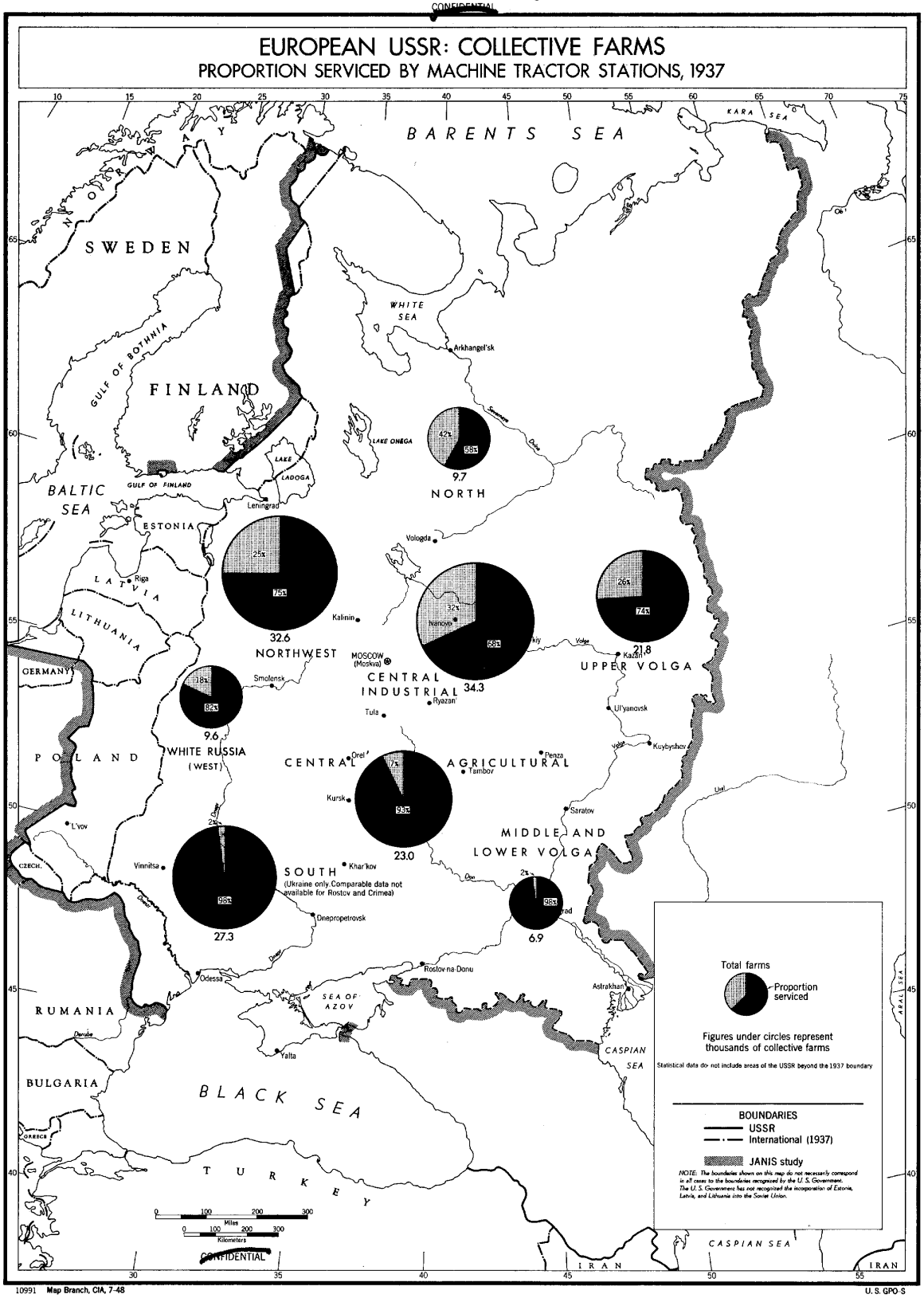
10989 Map Branch, CIA, 7-48 U.S. GPO-S

FIGURE IX-2
SOWN AREA, 1938
JANIS 40
CONFIDENTIAL



10990 Map Branch, CIA, 7-48 U.S. GPO-S

FIGURE IX-3
COLLECTIVE FARMS SERVICED BY MACHINE-TRACTOR STATIONS, 1937
JANIS 40
CONFIDENTIAL



In 1937 there were over 3,500 machine-tractor stations in European USSR. Each machine-tractor station, on the average, served 38 kolkhozy with a seeded area of about 49,000 acres. The number varied from 13 in the Middle and Lower Volga area, where collective farms are large, to 80 in the northwest where the farms are small (TABLE IX-3).

TABLE IX - 3

NUMBER OF MACHINE-TRACTOR STATIONS (MTS), COLLECTIVE FARMS SERVICED PER MTS, AND NUMBER OF TRACTORS AND COMBINES PER MTS, EUROPEAN USSR, 1937

Region	Number of MTS	Per MTS			
		Collective farms serviced		Number of tractors	Number of combines
		Number	Sown area		
			1,000 acres		
European USSR proper:					
North	126	45	19.7	37	3
Northwest	305	80	36.9	46	3
Central Industrial	387	61	46.5	54	8
Central Agricultural	595	36	47.9	55	14
Upper Volga	247	65	61.0	52	12
Middle and Lower Volga	528	13	54.1	76	29
South	1,148	26	54.2	70	24
West	200	40	32.3	36	3
All European USSR proper	3,536	38	48.9	60	17

In 1937 the machine-tractor stations on the average had 60 tractors and 17 combines, but the number ranged from 36 tractors and 3 combines per station in the West, to 76 tractors and 29 combines in the Middle and Lower Volga area. In the South and the Middle and Lower Volga, 98% of the collective farms were serviced at least to some extent by machine-tractor stations. The Central Agricultural region followed with 93%; the smallest percent of kolkhozy serviced by machine-tractor stations, less than 60%, was in the North (TABLE IX-4 and FIGURE IX-3).

The most mechanized field operation is plowing. Sowing and harvesting are much less mechanized in most regions. Thus, in the Ukraine, 85% of spring plowing was done with tractors, but only 40% of spring seeding

TABLE IX - 4

ALL COLLECTIVE FARMS, AND COLLECTIVE FARMS SERVICED BY MACHINE-TRACTOR STATIONS, BY REGION, EUROPEAN USSR, 1937

Region	All collective farms	Collective farms serviced by MTS	
		Compared to all collective farms	Sown area to sown area of all collective farms
European USSR proper:	*Thousands*	*Percent*	*Percent*
North	9.7	58	65
Northwest	32.6	75	82
Central Industrial	34.3	68	82
Central Agricultural	23.0	93	97
Upper Volga	21.8	74	85
Middle and Lower Volga	6.9	98	99
South*	27.3	98	99
West	9.6	82	87

* Ukraine only. No comparable data are available for Rostov and Crimea.

was mechanized. The gap in mechanization between plowing and other field work was much smaller in the Middle and Lower Volga and Crimea, while in the Rostovskaya Oblast' there was greater mechanization of seeding and harvesting than of plowing (TABLE IX-5).

A serious drawback in the work of the machine-tractor stations has been the poor maintenance of equipment, resulting in frequent breakdown and stoppage, and need for extensive repairs and overhauling. The excessive turnover of tractor drivers and combine operators, induced by poor living conditions and large arrears in payment of wages, was another unfavorable factor during the prewar period. By a decree of the Presidium of the Supreme Council of the USSR of 17 July 1940, tractor drivers and combine operators were prohibited from quitting their jobs without permission of the management.

World War II had a very adverse effect on machine-tractor stations. In the invaded zone, the Germans destroyed over 2,600 machine-tractor stations, and destroyed or removed 137,000 tractors and 49,000 combines and much other machinery, according to a report of a Special Soviet Investigating Commission.

TABLE IX - 5

MECHANIZATION OF WORK ON COLLECTIVE FARMS BY REGION, EUROPEAN USSR, 1937

Region	Spring plowing	Spring sowing		Fall plowing	Fall sowing	Harvesting of grain and legumes	
		All crops	Grains			Total	Combines only
European USSR proper:	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
North	34.1	3.3	4.1	57.5	10.7	2.9	2.7
Northwest	45.9	4.2	6.9	40.3	15.2	2.4	2.2
Central Industrial	59.2	15.9	20.2	49.5	27.4	7.0	6.9
Central Agricultural	76.3	30.7	37.1	52.5	35.5	16.5	16.3
Upper Volga	52.2	19.9	24.1	54.0	25.5	9.7	9.7
Middle and Lower Volga	91.4	75.5	85.1	84.9	85.0	74.5	58.9
South:							
Ukraine	85.0	39.9	44.6	71.6	38.7	44.5	39.6
Crimea	89.6	59.9	75.4	86.0	68.1	80.2	78.6
Rostov	83.0	83.6	94.0	82.1	98.8	83.5	62.1
West	55.9	5.9	10.0	50.0	12.5	2.0	1.4

In the uninvaded zone some tractors were withdrawn for army use, and the stations also lost, through army mobilization, most of their skilled personnel. The extent of the decline in tractor work can be gaged from the fact that, while the total volume of such work for the Soviet Union as a whole increased by 22% in 1945 over 1944, it still was less than half of the prewar volume. For European USSR proper, the decline was probably greater.

Reconstruction of the destroyed machine-tractor stations began immediately after the expulsion of the enemy from each region, and is still going on. The postwar Five-Year Plan, promulgated in March 1946, contemplates introduction during 1946-50 of not less than 325,000 new tractors, the bulk of which will undoubtedly go to the machine-tractor stations, and the creation of 950 new machine-tractor stations, most of which will probably be located in European USSR.

(3) Sovkhozy

The sovkhoz, or state farm, is a farm entirely owned and operated by the state, like any factory in the Soviet Union. The first state farms were organized during the early years of the Soviet regime from what was left of the estates that the peasants had not already seized. A new impetus to the development of state farming was given by the grain crisis of 1928-29, when the government encountered great difficulty in collecting grain from the peasants for the needs of the urban population. The government decided then to establish large mechanized state grain farms, primarily on uncultivated land in the drier areas of the Union. Later, during the collectivization campaign, peasant slaughtering of their livestock on a large scale created a severe livestock shortage. At that time the government established large-scale state farms to raise livestock. Similar ventures in state farming were made in other branches of agriculture.

The state farms were at first unwieldy and suffered from excessive specialization and from inefficient utilization of tractors and combines. These problems led during the 1930's to subdivision, transfer of some land to the kolkhozy, and emphasis on diversified farming.

In 1938 the state farms in European USSR accounted for less than 8% of the total crop area. The largest acreages under state farms were in the south, particularly the southeast, followed by the Middle and Lower Volga, the Central Agricultural, and the Central Industrial regions. The acreage under state farms in the northern regions was small (TABLE IX-2 and FIGURE IX-2).

In the newly incorporated territories, before they were occupied by the Soviet Union, small and medium-sized peasant holdings largely prevailed. During the interwar period all these territories had undergone more or less extensive agrarian reforms in which some redistribution of ownership in favor of the peasant farmer took place.

If 50 hectares (about 125 acres) is taken as a rough dividing line between smaller and larger properties, in Estonia and Lithuania over 80% of the land was in small and medium-sized holdings; in Latvia, about 75%; and, in the former Polish territories, about 65 percent. Much of the land in large holdings in the Polish territories was in forests or otherwise not used or usable for agricultural purposes. In Bessarabia, where details of distribution are available only for crop land, holdings up to 50 hectares occupied 94% of the total crop area in 1931.

A new redistribution has taken place since Soviet occupation, or reoccupation, of these territories. Detailed statistical data on the results of the new agrarian reform, however, are lacking.

C. Farm practices

The collectivization of agriculture has been accompanied, not only by a considerable mechanization of farm operations, but also by the government's strong emphasis on the adoption of certain farm practices tending to improve crop yields.

The government has a vital interest in increasing agricultural production, and improvement of yield per acre has been considered the principal means to this end since the early 1930's, when the major expansion of acreage took place.

While the acreage was being increased, during the early years of collectivization, the yield per acre declined, partly because of the inferior land brought under cultivation (extension of farming in the semiarid zone), but largely because of inefficient management and the poor work of the peasants on the new collective farms, which they were forced, as a rule, to join. This, coupled with the fact that the crop yields were generally lower in the Soviet Union than in Western Europe and the United States, stimulated governmental effort to increase the yields by adoption of better farm practices.

In comparing crop yields in the Soviet Union with those of the United States, and particularly Western Europe, there should not be overlooked, apart from the respective efficiencies of farm practices, the differences in climatic and economic conditions which are in no small measure responsible for variation in yields. Light precipitation and a short growing season in USSR tend toward low yields of crops. Similarly, until recent years, relative abundance of land and slight industrial and urban development, which limited a profitable market for agricultural products, favored extensive farming in Russia, with its low yields, as compared with the intensive farming based on high yields per unit of land in the industrialized western European countries.

A scientific system of crop rotation holds the center place in this government program of improved farm practices. This method was intended to replace the traditional three-field cropping system (winter grain, spring crop, fallow) in the north and central parts of the country, and the continuous cropping in the south and east until exhaustion of fertility.

While the character and number of crops and their rotation under the new system differ from region to region, usually involving a 7- to 10-year cycle, two features are considered essential to every cropping system: a sod crop to improve the soil and provide forage, and a fallow plowed as early as possible, preferably in the autumn, to conserve the moisture supply and for weed control. Weed infestation, as a result of careless tillage during the early years of collectivization, has become a major problem. Hence, the emphasis is placed on fallowing as a means of weed eradication, even if no special measures are needed for moisture conservation.

However, the effort of the government to introduce crop rotation in the 1930's was only partially successful. It was admitted by the Soviet Minister of Agriculture in 1939, (then, Commissar of Agriculture), that only 12% of the collective farms had a more or less satisfactory system of crop rotation. The agricultural planners were often responsible for this state of affairs by prescribing acreage goals inconsistent with the observance of the crop rotation system.

Whatever the improvement in rotation before the war, the situation, of course, greatly deteriorated with the German invasion, not only in the invaded regions but also in

the uninvaded area, where rotation was often neglected. A new decree of the Council of People's Commissars on "measures for improvement in the introduction and adoption of crop rotation in collective farms," published in June 1945, once more set up in detail a comprehensive government program on this problem.

As was pointed out earlier, conservation of soil moisture is of great importance in Soviet farming, so much of which is centered in the semiarid zone. Among farm practices designed to this end, retention of snow has received considerable attention. Similarly fall plowing, for seeding during the following spring, has been stressed in the Soviet production program. Fall plowing also has the advantage of easing the heavy load of field work in the spring, and has been increasingly practiced in Soviet agriculture.

Another measure to protect the crops from the effects of droughts and to control wind erosion, is planting of tree shelterbelts in the semiarid steppe regions. The Russians have been pioneers in this field and, by 1940, about 500,000 hectares (1,250,000 acres) of tree shelterbelts were planted in the Soviet Union, mostly in European USSR.

The war affected this work adversely. There was considerable destruction and neglect of the trees. A new impetus to the planting of tree shelterbelts, however, was given by the considerable emphasis on this point in the government's agricultural Plan for 1946 and the Five-Year Plan for 1946-50.

Great strides have been made in improving the quality of seed, especially since the passage on 29 June 1937 of the decree by the Council of the People's Commissars, entitled "Concerning the Measures for Improvement of Grain Seed."

A system has been developed to provide the collective and state farms with seed of pure strains. In the case of grain, it consists of three important stages: first, a plant-breeding station develops seed of pure strains; second, such seeds are supplied for propagation to a designated collective or state farm in each district, which specializes in seed production; third, this seed is delivered to a government agency in charge of the stock of seed of pure strains, and the agency, in exchange for ordinary seed, supplies the collective and state farms with pure strains for planting on special plots, to provide the seed supply for the farm. This system resulted in considerable progress in the use of seed of pure strains. In 1937, 42% of the total grain acreage was planted with such seed and, in 1940, 84%. Corresponding advances have also been made in other crops. The war retarded seed improvement, particularly in the regions invaded by the Germans. A new decree of the People's Commissar on "Improvement of the Grain Seed Supply," published in the Soviet press at the end of February 1945, outlined various measures for postwar recovery and further improvements in this field.

The progressive farm methods described above, as well as others, have been introduced on a large scale through Soviet centralized planning and direction. The beneficial effects, however, of government planning have often been offset by poor farm practices at the grassroots.

Extensive weed infestation has required a great deal of labor in the actual weeding of the fields. According to one Soviet authority, on some collective and state farms, the expenditure of labor for the weeding of wheat and flax fields constituted often more than half of the total labor required for the growing of these crops. Furthermore, weed infestation has necessitated much deeper plowing and consequently increased expenditure of draft power.

Another serious evil of Soviet agriculture is the untimely field work. Delayed plowing, seeding, harvesting, etc., were common during the early years of collectivization. Untimely seeding is highly detrimental to yields, especially in the semiarid region where the late crops may not have time to develop sufficiently to withstand the adverse effects of a hot, dry spell. Conditions had improved considerably in the later 1930's, but delay in harvesting, with consequent large crop losses, has been a much more persistent evil, especially in the case of grain and hay.

Much attention has been given by the Soviet Government to the problem of improving the efficiency of agricultural labor. The so-called Stakhanovist campaign, for increased labor productivity and speed-up of work, began first in industry, in 1935, and was soon extended to agriculture. It was carried on among the tractor drivers and combine operators, and among workers in animal husbandry and production of intensive crops, such as sugar beets, where individual labor counts for a great deal. The campaign for increased productivity was spurred by rewards to the pace setters.

Although the efficiency of labor on the collective farms was higher in the late 1930's than in the early days of collectivization, labor requirements for production of crops were still very high. According to a sample survey of collective farms made in 1937, production of winter grains, including preharvest and harvest operations, and hauling to delivery points, required 6.24 man-days per hectare (2.471 acres) in Dnepropetrovskaya Oblast', 8.89 in Odesskaya Oblast' in southern Ukraine, and 6.82 in Rostovskaya Oblast'—all regions of highly mechanized wheat production. While comparison with the United States is hazardous, since corresponding data in this country are given in man-hours rather than man-days, and it is difficult to convert Soviet man-days into man-hours, the superior American efficiency is indicated by the fact that in the United States the number of man-hours (not man-days) required for wheat production averages only 21.5 per 2.471 acres (1 hectare), and is as low as 11.4 in Kansas and 14.6 to 16.1 in the Dakotas.

Before World War II, farm methods in the newly incorporated territories (with the exception of the Baltic Republics and Königsberg) were rather backward. Although the lowlands of the old Kingdom of Rumania and Bessarabia are in a soil belt of exceptional fertility, crops are subject to extremes of temperature and precipitation. During the prewar period, farm practices had not advanced to include moisture conservation measures or modern methods of cropping, and farm equipment was primitive. Farm practices in other newly incorporated territories, particularly in the former Baltic Republics of Latvia and Estonia, and the East Prussia (Königsberg) district, were generally more progressive than in the former Rumanian provinces.

D. Fertilizers

(1) Manure

The extent to which manure is used varies markedly. In the nonblack-soil area with its poor podzolized leached soils, manure is absolutely essential for satisfactory crop yields, and is widely used. In the more fertile regions of the black-soil area it is less, or not at all, essential. In the whole of the Ukraine, for example, manure applied on the grain fields in 1934 was only three-fourths of that used in the Moscow province alone.

In general, the use of manure in European USSR decreases toward the south and southeast, where moisture rather than fertility of the soil is a limiting factor. In

1934 the Tatar ASSR used 6,365,000 metric tons of manure to fertilize the grain fields, but the neighboring Middle Volga region, to the south, with a grain acreage nearly three times as large, used only 2,890,000 metric tons. Still farther south, in the Lower Volga region (Saratov and Stalingrad provinces), about 100,000 metric tons were used that year.

Manure is used primarily for winter grains and but little for spring grain. In the Moskovskaya Oblast' for instance, over a third of winter rye and 60% of winter wheat acreage, but less than 5% of the oats acreage (planted in the spring) were manured in 1934. More manure is used for potatoes and sugar beets than for spring grain.

In general, the amount of manure used in Soviet Russia decreased by some 60% during the decade preceding World War II, and a Russian agricultural scientist has cited this as the main cause of an unfavorable plant food balance of the USSR crop area. The situation deteriorated still further during the war with the great decline of livestock and the consequent reduction in the quantity of manure available. For this reason alone, crop yields in the nonblack-soil area, where manure is essential, will also be affected adversely during the postwar period until livestock numbers are restored.

TABLE IX - 6

AVAILABLE SUPPLY OF COMMERCIAL FERTILIZERS, USSR
1928, 1932, 1938

Kind	1928	1932	1938
	Thousands of short tons		
Nitrates (20.5% N)	12. 7	24. 5	778. 0
Potash (41.0% K_2O)	4. 0	29. 8	343. 3
Superphosphate (18% P_2O_2)	228. 2	526. 5	1, 756. 2
Ground phosphate rock	13. 2	436. 5	667. 9
Total	258. 1	1, 017. 3	3, 545. 4

(2) Commercial fertilizer

The use of commercial fertilizer was greatly increased in the USSR during the interwar period, as indicated in TABLE IX-6. No separate data for European USSR proper are available. The increase in the use of commercial fertilizer paralleled the growth of the Soviet chemical industry and the discovery of phosphate and potash deposits.

Commercial fertilizer is used in the USSR primarily for the so-called industrial or technical crops (sugar beets, flax, cotton), and only in insignificant quantities for grains. The situation will doubtless continue during the postwar period. Whatever the output is of commercial fertilizer by the war-damaged Soviet chemical industry, it will be urgently needed for the recovery of the production of industrial crops.

E. Land utilization

Data on land utilization are given in TABLES IX-7 and IX-8. It will be noted from TABLE IX-8 that the proportion of meadows and pastures, and of arable land (except in Estonia), is higher in the newly incorporated territories than in European USSR proper; the proportion of forests is greater in European USSR than in the newly incorporated territories.

There are also considerable regional variations throughout European USSR. The proportion of arable land is higher, and that of meadows and pastures is lower, in the black-soil area than in the nonblack-soil area. In the Ukraine, for instance, arable land constitutes 69% and meadows and pastures 8.5% of total land, and in the western part of the Central Agricultural area (Kurskaya Oblast', 1935 frontiers), 76% and 8.8%, respectively. But, in White Russia (nonblack-soil area), arable land is 33.9% and meadows and pastures 22.3 percent. Still farther north, in the Leningrad area, arable land is only 12.5% and meadows and pastures 16.4%, but a much higher proportion of land in this area is in forests: 48.5% as against 31.1% in White Russia, and 8.4% in the Ukraine. The great importance of meadows and pastures in the economy of the nonblack-soil area is due to the need for manure for crop production on the poor soils of these regions; hence, the need of livestock and of forage.

Not all of the arable land is occupied by crops in any one year. Part of the land is lying fallow each year, either as tilled fallow in a regular system of rotation, or reverted to sod after continuous cropping exhausts the fertility of the soil. In European USSR proper, 81% of the arable land was under crops in 1938; and in the Baltic Republics, 86 percent. Most of the remaining arable land is occupied by tilled fallow. As was explained earlier, the practice of fallowing is considered essential in the USSR for conservation of soil moisture, which is the limiting factor in production in the large semiarid zone, and for weed control,

TABLE IX - 7

LAND UTILIZATION, EUROPEAN USSR

(Thousands of acres)

Region	Area with farm buildings	Fruit orchards and vineyards	Arable land	Permanent meadows	Pastures	Forests and brushland	Other	Total land
European USSR proper *	9, 894	1, 964	265, 425	47, 312	60, 001	291, 326	226, 410	902, 332
Newly incorporated areas:								
Estonia ***	.....	1	2, 718	2, 552	1, 764	2, 294	1, 463	10, 792
Latvia ***	.....	.....	5, 404	2, 236	1, 856	4, 317	2, 444	16, 257
Lithuania ***	.....	94	6, 778	**1, 720	**1, 097	2, 577	1, 490	13, 756
Polish †	.....	766	16, 940	5, 477	3, 572	10, 040	5, 272	42, 067
Rumanian †	.....	357	8, 041	143	1, 076	924	1, 850	12, 391

* Data are for 1935 exclusive of Rostovskaya Oblast'.
** 1935 Census.
*** Data are for 1938 (exceptions indicated).
† Data are for 1938.

FIGURE IX-4
CROP DISTRIBUTION, 1938
JANIS 40
CONFIDENTIAL

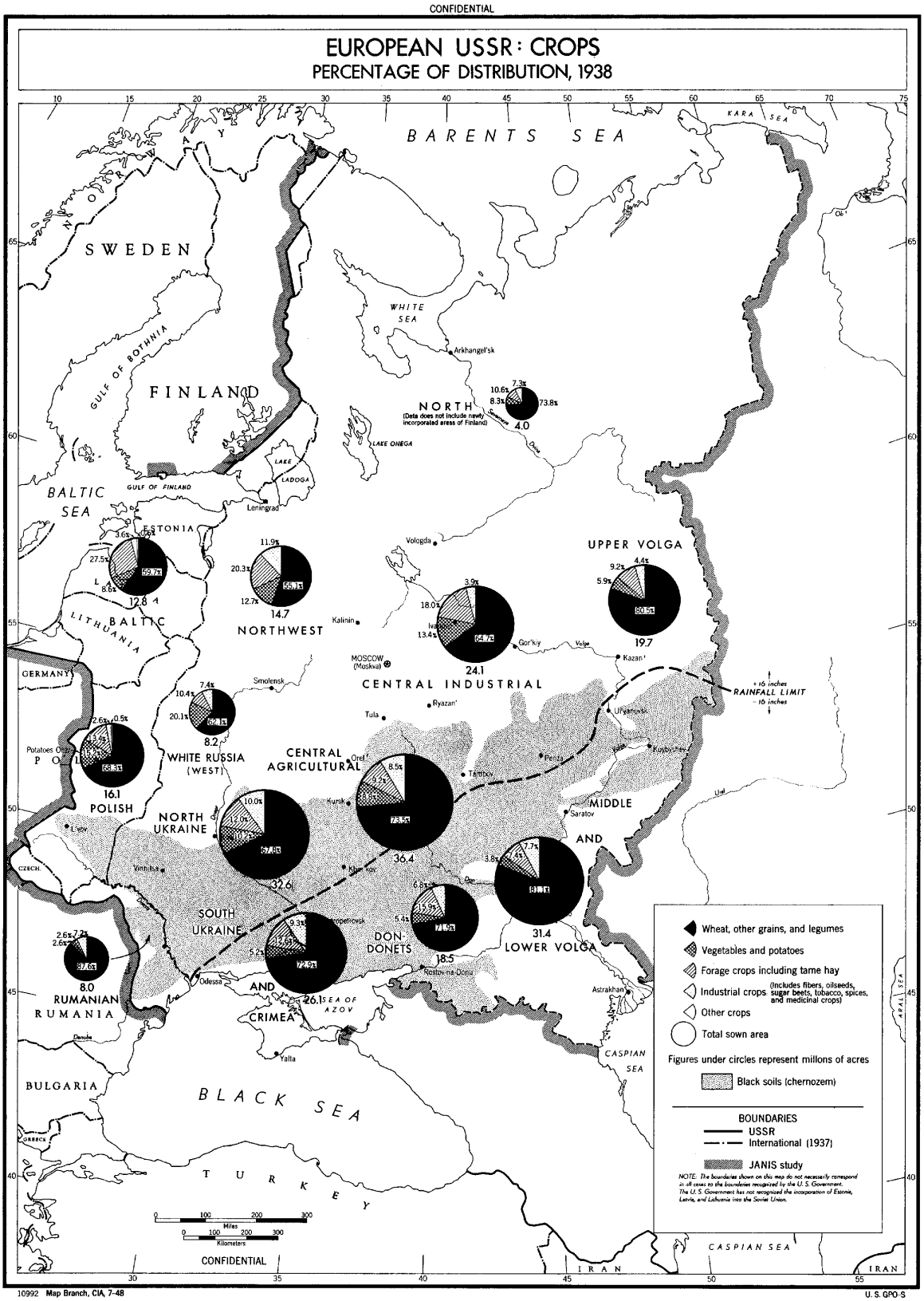


TABLE IX - 8

PERCENTAGE DISTRIBUTION OF TOTAL LAND AREA, EUROPEAN USSR

Region	Total land	Percent of total land: Area with farm buildings	Fruit orchards and vineyards	Arable land	Permanent meadows	Pastures	Forests and brushland	Other	Total
	1,000 acres								
European USSR proper*	902, 332	1. 1	0. 2	29. 4	5. 2	6. 7	32. 3	25. 1	100. 0
Newly incorporated areas:									
Estonia***	10, 792	....	....	25. 2	23. 6	16. 3	21. 3	13. 6	100. 0
Latvia***	16, 257	....	....	33. 2	13. 8	11. 4	26. 6	15. 0	100. 0
Lithuania***	13, 756	....	0. 7	49. 3	**12. 5	** 8. 0	18. 7	10. 8	100. 0
Polish†	42, 067	....	1. 8	40. 3	13. 0	8. 5	23. 9	12. 5	100. 0
Rumanian†	12, 391	....	2. 9	64. 9	1. 2	8. 7	7. 4	14. 9	100. 0

* Data, except for Rostovskaya Oblast', are for 1935.
** 1935 Census.
*** Data are for 1938 (exceptions indicated).
† Data are for 1938.

rendered even more necessary by the serious weed infestation in the region invaded during the war.

The arable, or crop, land in European USSR can be increased through land reclamation. During the years 1933-37, over 7.3 million acres were added to the crop land in the nonblack-soil area (Northern, Northwestern, Western, Central Industrial, and Upper Volga regions). Of this area, prior to reclamation, 13% was meadows and pastures (presumably of a very poor type), 27% brushland, 29% small woods, 15% forests, 13% cut-over land, and other land 3 percent.

There is still a considerable area of brushland, marshland, and, in the more northern regions, of forest land, which could be adapted to crop production. In White Russia (West) drainage of extensive marshes would provide a sizable addition to the crop land. A government decree of 6 March 1941 outlined a plan for draining nearly 4 million acres during the years 1941-47, of which over 1.3 million acres were to be adapted to crops and nearly 2 million acres to meadows and pastures. The war interfered with this program and caused serious damage to the drainage system.

The drainage operations in White Russia were resumed after the war, but on a more modest scale. The postwar Five-Year Plan, 1946-50, specifies drainage of 667,000 acres of agricultural land in the enlarged territory of White Russia, which now includes western provinces formerly under Polish control. In the Ukraine, the plan specifies drainage of 100,000 acres and irrigation of 75,000 acres of agricultural land, some of which may have been under irrigation before the war. Additional land can be brought into cultivation by irrigation in the Middle and Lower Volga regions. Irrigation in this area is in its infancy, and long-range projects for this purpose were being developed before the war. The postwar Five-Year Plan provides for an irrigation project in the so-called Volga-Akhtuba depression between Stalingrad and Astrakhan'. According to a Moscow press report of 3 March 1945, some 100,000 acres were scheduled to be opened within five years.

In general, it appears that whatever the theoretical possibilities, little new acreage will be brought under cultivation by reclamation in European USSR during the years 1947 to 1950, while the government is preoccupied with the problem of restoring Soviet agriculture to the prewar level.

92. FARM PRODUCTS AND FISHING

A. Crops

(1) General crop pattern

The outstanding feature of the European USSR crop pattern is the predominance of grain, which greatly outranks all the other crops (TABLE IX-9, FIGURE IX-4). The proportion of grains (including grain legumes, such as peas, lentils, etc.) in the total acreage of European USSR proper constituted, in 1938, nearly 72 percent. (In 1928, it had been even larger—79 percent.) The Volga regions have the highest proportion of grain, 80 percent. It decreases westward, and is least in the northwest with 55% of the acreage under grain. In the Baltic Republics, in 1938, it was nearly 60%; in the former Polish territories, 68%; and, in the former Rumanian territories, 88 percent (TABLES IX-10 to IX-12).

Among the nongrain crops, forage crops, including tame hay, hold first place. They accounted, in 1938, for about 12% of the total acreage in European USSR proper, but the proportion is higher in the Northwestern and Central Industrial regions, with about a fifth of the acreage in forage crops. It is especially high in the Baltic Republics, where forage crops occupy more than a fourth of the acreage. These crops are considerably less important in the former Polish territories than in the Baltics, and are insignificant in the former Rumanian territories.

Potatoes and other vegetables occupy between 8% and 9% of the acreage of European USSR proper but they are much more important in the western and central parts of the country than in the eastern and the southern. The region where they are especially significant is White Russia (West), where a fifth of the acreage is under potatoes and vegetables, largely the former. In the former Polish territories potatoes alone account for 15% of the acreage, but they are less important in the Baltic Republics.

Finally, there are the so-called industrial or, as the Russians term them, technical crops, which provide the raw materials for such manufacturing industries as the textile, sugar, vegetable oil, and tobacco. These crops accounted for nearly 8% of the acreage in European USSR proper, where they were especially important in the northwest and the south (Ukraine and Crimea). In the former Rumanian territories, 7% of the acreage was under these crops, but less than 4% in the Baltic Republics and less

TABLE IX - 9

TOTAL SOWN AREA AND PERCENTAGE DISTRIBUTION OF SPECIFIED CROPS, EUROPEAN USSR, 1938

Region	Total sown area	All wheat	Other grains and legumes	Industrial crops	Forage crops including tame hay	Vegetables including potatoes	Other crops	Total
European USSR proper:	*1,000 acres*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
North	4,043.8	10.4	63.4	7.3	10.6	8.3	....	100.0
Northwest	14,679.7	7.9	47.2	12.0	20.3	12.6	....	100.0
Central Industrial	24,053.0	11.9	52.8	4.0	17.9	13.4	....	100.0
Central Agricultural	36,425.8	17.4	56.2	8.6	9.0	8.8	....	100.0
Upper Volga	19,744.3	11.9	68.5	4.4	9.2	6.0	....	100.0
Middle and Lower Volga	31,403.9	39.3	41.8	7.7	7.4	3.8	....	100.0
South:	(77,161.9)	(30.9)	(39.5)	(9.0)	(13.2)	(7.4)	....	(100.0)
North Ukraine	32,616.7	18.5	49.2	10.1	12.0	10.2	....	100.0
South Ukraine and the Crimea	26,051.7	42.2	30.7	9.3	12.6	5.2	....	100.0
Don-Donets Region	18,493.5	36.9	35.0	6.8	15.9	5.4	....	100.0
West	8,245.2	6.7	55.4	7.4	10.4	20.1	....	100.0
All European USSR proper	215,757.6	23.1	48.4	7.9	12.1	8.5	....	100.0
Newly incorporated areas:								
Finnish	625.5	7.3	30.5	0.1	57.6	4.5	....	100.0
Baltic republics	12,834.6	8.0	51.7	3.6	27.5	8.6	0.6	100.0
Königsberg	1,422.5	5.2	49.4	0.3	26.4	8.0	10.7	100.0
Polish	16,093.4	11.6	56.7	2.6	13.4	15.2	0.5	100.0
Rumanian	7,968.2	29.3	58.3	7.2	2.6	2.6	....	100.0
All newly incorporated areas	38,944.2	13.7	52.8	4.4	17.0	9.9	2.2	100.0
All European USSR	254,701.8	21.7	49.1	7.4	12.8	8.7	0.3	100.0

TABLE IX - 10

CROP AREA, EUROPEAN USSR, 1938

(Thousands of acres)

	European USSR proper	Baltic Republics				Territory acquired from:*				Total acquired territories	Grand total
		Estonia	Latvia	Lithuania	Total	Finland	Poland	Rumania	East Prussia (Königsberg)		
Winter wheat	24,608.7	67.7	166.8	355.6	590.1	3.0	1,580.0	1,894.3	63.9	4,131.3	28,740.0
Spring wheat	25,256.6	104.5	181.6	144.8	430.9	42.7	287.6	442.5	9.6	1,213.3	26,469.9
Total wheat	(49,865.3)	(172.2)	(348.4)	(500.4)	(1,021.0)	(45.7)	(1,867.6)	(2,336.8)	(73.5)	(5,344.6)	(55,209.9)
Rye	42,986.5	365.2	709.2	1,304.7	2,379.1	58.6	4,538.5	530.3	282.2	7,788.7	50,775.2
Oats	26,699.9	367.9	859.7	877.4	2,105.0	105.3	2,277.8	152.7	140.8	4,781.6	31,481.5
Barley	14,455.1	216.7	439.6	536.2	1,192.5	24.2	1,213.0	1,276.3	103.1	3,809.1	18,264.2
Corn	3,268.6	....	....	....	....	....	204.4	2,604.9	....	2,809.3	6,077.9
Millet	5,822.2	....	....	....	....	....	117.4	6.7	....	124.1	5,946.3
Buckwheat	4,137.2	....	11.9	19.8	31.7	....	500.1	3.0	....	534.8	4,672.0
Potatoes	14,892.0	192.7	340.2	459.6	992.5	27.9	2,450.2	138.6	110.6	3,719.8	18,611.8
Legumes	4,914.1	23.0	87.7	135.9	246.6	2.5	213.2	59.0	7.4	528.7	5,442.8
Vegetables	2,392.4	21.3	31.4	63.0	115.7	....	....	27.7	3.1	146.5	2,538.9
Sugar beets	2,708.2	....	33.6	21.0	54.6	....	43.5	32.6	2.9	133.6	2,841.8
Sunflower seed	5,135.7	....	....	....	....	....	....	327.4	....	327.4	5,463.1
Flaxseed	461.6	....	....	....	....	....	....	....	....	....	....
Flax for fiber	4,220.2	....	....	....	....	....	....	....	....	....	....
Total flax	(4,681.8)	(57.8)	(161.8)	(192.5)	(412.1)	(1.0)	(246.6)	(4.9)	(1.4)	(666.0)	(5,347.8)
Hemp	1,255.5	....	....	....	....	....	61.8	26.2	....	88.0	1,343.5
Cotton	778.6	....	....	....	....	....	....	....	....	....	778.6
Tobacco	66.2	....	....	....	....	....	9.4	7.7	....	17.1	83.3
Makhorka	233.5	....	....	....	....	....	....	....	....	....	233.5
Tame hay	23,434.7	460.9	1,462.6	1,099.1	3,022.6	353.6	....	129.0	48.2	3,533.4	26,988.1
Other forage crops	2,563.4	100.8	111.7	269.3	481.8	6.7	2,156.7	74.9	326.7	3,046.8	5,610.2
Other crops	5,466.7	285.9	206.1	287.4	779.4	....	193.2	229.5	322.6	1,524.7	6,991.4
Total crops	215,757.6	2,264.4	4,803.9	5,766.3	12,834.6	625.5	16,093.4	7,968.2	1,422.5	38,944.2	254,701.8

* Figures for territory acquired from Finland, Poland, Rumania, and Germany are estimated.

TABLE IX - 11

PERCENTAGE OF TOTAL SOWN AREA OCCUPIED BY SPECIFIED CROPS, EUROPEAN USSR, 1938

Crop	European USSR proper	Baltic Republics				Territory acquired from:*				Total acquired territories	Grand total
		Estonia	Latvia	Lithuania	Total	Finland	Poland	Rumania	East Prussia (Königsberg)		
Winter wheat	11.4	3.0	3.5	6.2	4.6	0.5	9.8	23.8	4.5	10.6	11.3
Spring wheat	11.7	4.6	3.8	2.5	3.4	6.8	1.8	5.5	0.7	3.1	10.4
Total wheat	(23.1)	(7.6)	(7.3)	(8.7)	(8.0)	(7.3)	(11.6)	(29.3)	(5.2)	(13.7)	(21.7)
Rye	19.9	16.1	14.8	22.6	18.5	9.4	28.2	6.7	19.8	20.0	20.0
Oats	12.4	16.2	17.9	15.2	16.4	16.8	14.2	1.9	9.9	12.3	12.4
Barley	6.7	9.6	9.2	9.3	9.3	3.9	7.5	16.0	7.2	9.8	7.2
Corn	1.5	....	....	....	....	....	1.3	32.7	....	7.2	2.4
Millet	2.7	....	....	....	....	....	0.7	0.1	....	0.3	2.3
Buckwheat	1.9	....	0.2	0.3	0.2	....	3.1	....	....	1.4	1.8
Potatoes	6.9	8.5	7.1	8.0	7.7	4.5	15.2	1.7	7.8	9.6	7.3
Legumes	2.3	1.0	1.8	2.3	1.9	0.4	1.3	0.8	0.5	1.4	2.1
Vegetables	1.1	0.9	0.6	1.1	0.9	....	....	0.4	0.2	0.4	1.0
Sugar beets	1.2	....	0.7	0.4	0.4	....	0.3	0.4	0.2	0.3	1.1
Sunflower seed	2.4	....	....	....	....	....	....	4.1	....	0.9	2.2
Flaxseed	0.2	....	....	....	....	....	....	....	....	....	....
Flax for fiber	1.9	....	....	....	....	....	....	....	....	....	....
Total flax	(2.1)	(2.6)	(3.4)	(3.3)	(3.2)	(0.1)	(1.5)	(0.1)	(0.1)	1.7	(2.1)
Hemp	0.6	....	....	....	....	....	0.4	0.3	....	0.2	0.5
Cotton	0.4	....	....	....	....	....	....	....	....	....	0.3
Tobacco	....	....	....	....	....	....	0.1	0.1	....	....	....
Makhorka	0.1	....	....	....	....	....	....	....	....	....	0.1
Tame hay	10.9	20.4	30.4	19.1	23.6	56.5	....	1.6	3.4	9.1	10.6
Other forage crops	1.2	4.5	2.3	4.7	3.8	1.1	13.4	0.9	23.0	7.8	2.2
Other crops	2.6	12.6	4.3	5.0	6.1	....	1.2	2.9	22.7	3.9	2.7
Total crops	10.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

* Figures for territory acquired from Finland, Poland, Rumania, and Germany are estimated.

TABLE IX - 12

SOWN AREA OF SPECIFIED CROPS BY REGION, EUROPEAN USSR, 1938

(Thousands of acres)

Region	Winter wheat	Spring wheat	Rye	Oats	Barley	Potatoes	Sunflower seed	Sugar beets	Flax fiber	Flax seed	Total flax	Hemp
European USSR proper:												
North	46.7	373.4	936.3	947.6	532.5	304.2	.....	.....	291.1	.....	291.1	2.2
Northwest	464.3	693.1	2,979.5	2,740.8	611.3	1,657.3	.....	....	1,731.2	.....	1,731.2	18.8
Central Industrial	1,515.0	1,346.0	5,418.9	5,216.8	228.8	2,872.5	10.6	22.2	727.0	8.2	735.1	79.3
Central Agricultural	2,812.0	3,511.3	9,280.3	5,303.8	1,031.4	2,849.6	1,274.3	685.9	76.4	47.7	124.0	584.6
Upper Volga	111.2	2,246.9	6,392.7	4,632.4	745.5	1,084.3	63.5	.....	596.0	67.2	663.2	87.0
Middle and Lower Volga	579.2	11,763.4	6,751.3	2,280.0	1,457.6	677.8	1,455.7	9.1	....	150.7	150.7	22.7
South:	(18,897.7)	(4,955.6)	(8,939.8)	(4,483.9)	(9,231.9)	(3,883.2)	(2,331.6)	(1,990.9)	(278.2)	(187.8)	(466.0)	(403.5)
North Ukraine	5,206.4	834.7	5,920.3	2,901.7	2,896.5	2,636.6	364.2	1,766.8	278.2	1.7	279.9	294.8
South Ukraine and the Crimea	10,256.9	740.6	1,296.0	857.2	3,724.6	695.3	955.0	219.2	....	82.0	92.0	107.0
Don-Donets Region	3,434.4	3,380.3	1,723.5	725.0	2,610.8	551.3	1,012.4	4.9	....	104.0	104.0	1.7
West	182.6	366.9	2,287.7	1,094.7	616.0	1,563.2	.....	.....	520.4	.....	520.4	57.3
Total European USSR proper	24,608.7	25,256.6	42,986.5	26,699.9	14,455.1	14,892.0	5,135.7	2,708.2	4,220.2	461.6	4,681.8	1,255.5
Newly incorporated areas:												
Finnish	3.0	42.7	58.6	105.3	24.2	27.9	.....	.....	....	.....	1.0	....
Baltic	590.1	430.9	2,379.1	2,105.0	1,192.5	992.5	.....	54.6	....	.....	412.2	....
Königsberg	63.9	9.6	282.2	140.8	103.1	110.6	.....	2.9	....	.....	1.4	....
Polish	1,580.0	287.6	4,538.5	2,277.8	1,213.0	2,450.2	.....	43.5	....	.....	246.6	61.8
Rumanian	1,894.3	442.5	530.3	152.7	1,276.3	138.6	327.4	32.6	....	.....	4.9	26.2
Total European USSR	28,740.0	26,469.9	50,775.2	31,481.5	18,264.2	18,611.8	5,463.1	2,841.8	....	.....	5,347.9	1,343.5

than 3% in the former Polish territories. It should be borne in mind, however, that the economic value of these intensive crops is far greater than their relative place in the acreage indicates. The official value which was placed on the output per acre of industrial crops in the Soviet Union, in 1937, was 46% greater than the official value of output per acre of all other crops.

The postwar Five-Year Plan contemplates a decrease in grain acreage as compared with prewar, and an increase in the area under vegetables, potatoes, and forage crops, especially perennial grasses. The following planned acreage changes in the Ukraine may be considered more or less typical of the contemplated shifts in European USSR. Grains are to decrease in 1950 to 48.4 million acres as compared with 50.5 million acres in 1940, or 4 percent. The acreage of industrial crops will remain practically the same. Vegetable and potato acreages are to increase to a little over 7 million as compared with 6.8 million in 1940, or 4 percent; forage crops are to increase to 13.4 million as compared with 10.6 million, or 27 percent. Of these forage crops, the area under perennial grasses in the Ukraine is to be increased to 8.3 million acres in 1950 as compared with 4.2 million in 1940, or to become nearly double. The contemplated decrease in the grain area is to be more than offset by increased yields per acre, so that production is expected to rise substantially. However, acreage goals are much more easily achieved than yield goals, since the latter depend greatly on weather conditions, and on good farm practices which Soviet experience shows are not easily or rapidly adopted on a wide scale.

The emphasis on the seeding of perennial grasses, which according to the government plan by 1950 should occupy 11% in the Ukraine and 13.5% for the USSR as a whole, compared with 5.7 and 7.2% respectively in 1940, is not only for the purpose of increasing the available forage supply but, also, to raise the fertility of the soil. The physical structure of the soil is improved by perennial grasses. The leguminous grasses, such as clover and alfalfa, the seeding of which is recommended in combination with cereal grasses such as timothy, also enrich the soil with nitrogen (an essential plant nutrient), both directly through the roots of leguminous plants and indirectly through the increase in the quantity of manure resulting from a larger forage supply.

TABLE IX - 13

ACREAGE, YIELD, AND PRODUCTION OF PRINCIPAL CROPS, EUROPEAN USSR PROPER, AVERAGE 1933 TO 1937

Crop	Acreage	Official yield*	Production	Estimated yield	Production
	1,000 acres	*Short tons per acre*	*1,000 short tons*	*Short tons per acre*	*1,000 short tons*
Winter wheat	20, 566. 6	0. 49	10, 077. 6	0. 42	8, 638. 0
Spring wheat	23, 563. 5	0. 36	8, 482. 9	0. 31	7, 304. 7
Total wheat	(44, 130. 1)	(0. 42)	(18, 460. 5)	(0. 36)	(15, 942. 7)
Winter rye	47, 800. 5	0. 43	20, 554. 2	0. 37	17, 686. 2
Spring barley	13, 949. 8	0. 45	6, 277. 4	0. 39	5, 440. 4
Oats	28, 548. 7	0. 44	12, 561. 0	0. 38	10, 848. 5
Millet	9, 791. 6	0. 24	2, 350. 0	0. 21	2, 056. 2
Corn	4, 090. 2	0. 52	2, 126. 9	0. 47	1, 914. 2
Buckwheat	3, 954. 6	0. 27	1, 067. 7	0. 24	949. 1
Other grains and legumes	9, 526. 4	0. 30	2, 836. 6	0. 20	1, 863. 5
Total grains	(161, 791. 9)	(0. 41)	(66, 334. 7)	(0. 35)	(56, 627. 2)
Potatoes	13, 746. 2	3. 81	52, 373. 0	..	.....
Sugar beets	2, 822. 1	5. 53	15, 606. 2	..	.....
Sunflower seed	5, 635. 4	0. 26	1, 465. 2	..	.....
Flax:	5, 185. 9	..	.....	..	.....
Fiber	.....	0. 12	579. 5	..	.....
Seed	.....	0. 13	674. 2	..	.....
Hemp:	1, 078. 3	..	.....	..	.....
Fiber	.....	..	.....	0. 11	118. 6
Seed	.....	..	.....	0. 18	194. 1
Cotton**	765. 3	0. 21	160. 7	..	.....
Tobacco	67. 5	0. 32	21. 6	..	.....
Makhorka	234. 5	..	.....	0. 40	93. 8

* Official yield data for the USSR as a whole were assumed to be applicable, and were used where the crop was predominantly grown in European USSR proper.

** 1937 only. Earlier years are not representative since these are new cotton-growing regions.

It should also be noted that a considerable increase in the forage supply could be achieved by better utilization of natural meadows and pastures. Little has been done to improve them and they were bypassed in the progress of agricultural mechanization, which rendered very little aid to haying. In fact delay in harvesting, which became common under collectivization, resulted in serious losses

TABLE IX - 14

ACREAGE, YIELD, AND PRODUCTION OF PRINCIPAL CROPS, BALTIC REPUBLICS, AVERAGE 1933 TO 1937

Crop	Estonia			Latvia			Lithuania			Total	
	Acreage	Yield	Production	Acreage	Yield	Production	Acreage	Yield	Production	Acreage	Production
	1,000 acres	*Short tons per acre*	*1,000 short tons*	*1,000 acres*	*Short tons per acre*	*1,000 short tons*	*1,000 acres*	*Short tons per acre*	*1,000 short tons*	*1,000 acres*	*1,000 short tons*
Winter wheat	51. 1	0. 65	33. 2	183. 6	0. 67	122. 7	388. 7	0. 55	213. 6	623. 4	369. 5
Spring wheat	109. 0	0. 41	45. 1	149. 2	0. 50	74. 5	124. 0	0. 45	56. 1	382. 2	175. 7
Total wheat	(160. 1)	(0. 49)	(78. 3)	(332. 8)	(0. 59)	(197. 2)	(512. 7)	(0. 53)	(269. 7)	(1, 005. 6)	(545. 2)
Rye	360. 0	0. 61	218. 3	663. 7	0. 61	405. 2	1, 236. 0	0. 54	664. 1	2, 259. 7	1, 287. 6
Barley	248. 3	0. 40	100. 4	458. 9	0. 48	220. 7	516. 4	0. 53	274. 4	1, 223. 6	595. 5
Oats	345. 0	0. 42	146. 2	797. 6	0. 50	395. 6	853. 7	0. 47	404. 9	1, 996. 3	946. 7
Legumes	15. 8*	0. 39	6. 2*	100. 1	0. 44	43. 8	152. 0	0. 36	55. 1	267. 9	105. 1
Potatoes	179. 6	5. 83	1, 047. 2	287. 6	5. 90	1, 698. 2	444. 3	5. 29	2, 350. 4	911. 5	5, 095. 8
Sugar beets	....	....	....	33. 9	8. 64	293. 0	15. 6	9. 03	140. 9	49. 5	433. 9
Flax	62. 8	....	....	144. 3	....	....	182. 6	....	....	389. 7	....
Fiber	....	0. 14	9. 1	....	0. 14	20. 9	....	0. 16	29. 4	....	59. 4
Seed	....	0. 15	9. 7	....	0. 14	19. 6	....	0. 19	34. 8	....	64. 1

* Includes buckwheat.

of hay and deterioration of its quality and caused considerable concern to the government. For acreages, yields, and production of principal crops, see TABLES IX-13 to IX-18.

TABLE IX - 15

ACREAGE, YIELD, AND PRODUCTION OF PRINCIPAL CROPS, FINNISH TERRITORY, 1938

	Acreage	Yield	Production
	1,000 acres	*Short tons per acre*	*1,000 short tons*
Wheat	42. 4	0. 83	35. 4
Rye	70. 7	0. 67	47. 6
Barley	23. 0	0. 72	16. 6
Oats	114. 5	0. 79	89. 9
Potatoes	27. 8	5. 97	165. 9
Flax and hemp (fiber)	0. 9	0. 14	0. 1

TABLE IX - 16

ACREAGE, YIELD, AND PRODUCTION OF PRINCIPAL CROPS, FORMER EAST PRUSSIAN TERRITORY (KÖNIGSBERG), 1938

Crop	Acreage	Yield	Production
	1,000 acres	*Short tons per acre*	*1,000 short tons*
Winter wheat	63. 9	0. 95	60. 4
Spring wheat	9. 6	0. 89	8. 5
Total wheat	(73. 5)	(0. 94)	(68. 9)
Rye	282. 2	0. 93	262. 1
Barley	103. 1	0. 96	98. 8
Oats	140. 8	0. 93	130. 4
Mixed grains	169. 4	0. 97	164. 5
Total grains	(769. 0)	(0. 94)	(724. 7)
Potatoes	110. 6	8. 14	900. 1
Sugar beets	2. 9	12. 79	37. 1

TABLE IX - 17

ACREAGE, YIELD, AND PRODUCTION OF PRINCIPAL CROPS, FORMER POLISH TERRITORIES, AVERAGE 1933 TO 1937

Crop	Acreage	Yield	Production
	1,000 acres	*Short tons per acre*	*1,000 short tons*
Winter wheat	1, 457. 1	0. 50	734. 7
Spring wheat	313. 3	0. 44	136. 7
Total wheat	(1, 770. 4)	(0. 49)	(871. 4)
All rye	4, 333. 6	0. 44	1, 914. 1
Barley	1, 245. 4	0. 46	569. 0
Oats	2, 219. 5	0. 43	964. 4
Buckwheat	535. 7	0. 30	161. 4
Corn	214. 7	0. 45	96. 6
Millet	121. 6	0. 46	55. 6
Other grains	85. 2	0. 40	33. 7
Total grains	(10, 526. 1)	(0. 44)	(4, 666. 2)
Legumes	250. 8	0. 35	86. 9
Potatoes	2, 266. 6	4. 75	10, 763. 5
Sugar beets	30. 4	7. 66	233. 0
Rape seed	38. 5	0. 37	14. 2
Flax	196. 9	....	....
Fiber	.....	0. 12	23. 7
Seed	.....	0. 22	43. 4
Hemp	61. 5	....	....
Fiber	.....	0. 15	9. 3
Seed	.....	0. 25	15. 2
Tobacco	7. 9	0. 72	5. 7
Hops	4. 9	0. 22	1. 1

TABLE IX - 18

ACREAGE, YIELD, AND PRODUCTION OF PRINCIPAL CROPS, FORMER RUMANIAN TERRITORIES, AVERAGE 1933 TO 1937

Crop	Acreage	Yield	Production
	1,000 acres	*Short tons per acre*	*1,000 short tons*
Winter wheat	1, 447. 2	0. 39	559. 4
Spring wheat	504. 6	0. 25	126. 2
Total wheat	(1, 951. 8)	(0. 35)	(685. 6)
All rye	398. 3	0. 42	168. 4
Barley	1, 754. 2	0. 31	549. 0
Corn	2, 742. 1	0. 41	1, 112. 7
Oats	196. 7	0. 34	66. 9
Millet	21. 0	0. 15	3. 1
Buckwheat	5. 7	0. 32	1. 8
Other grains	1. 7	0. 24	0. 4
Total grains	(7, 071. 5)	(0. 37)	(2, 587. 9)
Legumes	169. 8	0. 19	33. 1
Potatoes	172. 5*	4. 06	700. 1**
Sugar beets	23. 0	8. 10	186. 3
Sunflowers	348. 9	0. 41	144. 0
Rape seed	72. 4	0. 17	12. 2
Soybeans***	48. 2	0. 34	16. 6
Flax	14. 3	....	....
Fiber	.....	0. 16	2. 3
Seed	.....	0. 15	2. 2
Hemp	25. 9	....	.....
Fiber	.....	0. 25	6. 6
Seed	.....	0. 26	6. 8
Tobacco	7. 7	0. 30	2. 3

* Excludes 17.8 thousand acres of intertilled potatoes.
** Excludes 1.6 thousand short tons of intertilled potatoes.
*** Three-year average, 1935-37.

(2) Grains

(a) Wheat.—This grain had forged ahead in the 1930's as the leading crop of European USSR. In 1938 it accounted for 23% of the total crop area in European USSR proper, and for 29% in the former Rumanian provinces. In the Baltic Republics and former Polish provinces, it was much less important (TABLE IX-9 and FIGURE IX-5).

Where winters are mild, as in western and most of central Europe, wheat is usually sown in the fall and harvested during the following summer. But in regions of more severe winters, such as eastern USSR, Canada, and parts of the United States, wheat is sown in the spring for harvest during the summer of the same year. Thus, the harvest of any particular year, say 1946, in countries like the USSR and the United States, where both types of wheat are extensively grown, includes winter wheat sown during the fall of 1945, as well as wheat sown in the spring of 1946. TABLES IX-19 and IX-20 show planting and harvesting dates.

The winter and spring wheat varieties are distinct, and winter wheat sown in the spring does not, like spring wheat, mature during the same year. Winter and spring wheats differ in the length of their growing period, their yields, and their nutritive qualities. Winter wheat usually brings higher yields per acre than spring wheat (TABLE IX-13), the difference being associated with the greater length of the growing period.

The 1938 acreage in European USSR proper was almost equally divided between spring and winter wheat. Prior to the 1930's, however, spring varieties predominated, accounting in 1927 for about 60% of the acreage. In the newly incorporated territories, winter wheat is grown for the most part (TABLES IX-10 and IX-11).

TABLE IX - 19

APPROXIMATE BEGINNING PLANTING DATES FOR WHEAT, OATS, AND BARLEY, BY REGION, EUROPEAN USSR PROPER, AVERAGE 1922 TO 1926*

Region	Wheat	Oats	Barley
North	May 16–21	May 12–17	May 16–27
Northwest	May 7	May 11	May 17
Central Industrial	May 10	May 7	May 17
Central Agricultural	April 20	April 20	April 19
Upper Volga	May 7–13	May 5–9	May 12–13
Middle Volga	April 29	April 29	May 1
Lower Volga	April 11	April 14	April 14
South:			
North Ukraine	April 7–13	April 8–13	April 9–14
South Ukraine and Crimea.	March 11–26	March 17–27	March 16–27
Don-Donets Region	March 25–April 3	March 30–April 6	March 27–April 4
West	May 2	May 10	May 8

* The regions for which the data for 1922–26 were given were arranged to correspond as closely as possible to the regions used in this study. It was found desirable to divide the Middle and Lower Volga region into its two parts because of the great difference in planting dates.

TABLE IX - 20

APPROXIMATE BEGINNING HARVESTING DATES FOR WHEAT, RYE, OATS, AND BARLEY, BY REGION, EUROPEAN USSR PROPER, AVERAGE 1922 TO 1926*

Region	Spring wheat	Winter rye	Oats	Barley
North	August 30	Aug. 9–18	Aug. 30–Sept 1	August 25
Northwest	August 14	July 24	August 19	August 16
Central Industrial.	August 14	July 29	August 18	August 23
Central Agricultural.	July 29	July 16	July 31	July 25
Upper Volga	Aug. 17–20	July 22–30	Aug. 20–22	Aug. 12–19
Middle Volga	August 4	July 19	August 4	August 1
Lower Volga	July 18	July 4	July 24	July 16
South:				
North Ukraine	July 19–28	July 8–15	July 20–30	July 17-22
South Ukraine and Crimea.	July 12–13	June 29–July 3	July 10–16	July 3–11
Don-Donets Region.	July 12–16	July 4–8	July 14–20	July 10–14
West	August 9	July 20	August 17	August 4

* The regions according to which the data for 1922–26 were given were arranged to correspond as closely as possible to the regions used in this study. It was found desirable to divide the Middle and Lower Volga region into its two parts because of the great difference in harvesting dates.

There are distinct winter and spring wheat belts in the USSR. Most of the winter wheat is concentrated in the south and southwest (the Ukraine and the Crimea). Spring wheat is concentrated in the Middle and Lower Volga and the Central Agricultural region (FIGURE IX-5). Wheat is primarily a crop of the black-soil area, but there was a marked expansion of the wheat acreage in the non-black-soil area during the 1930's. The acreage there increased six- to seven-fold from 1928 to 1938. Nevertheless, out of a total wheat acreage of 50 million acres, only a little more than 7 million acres were grown in the non-black-soil area in 1938.

It should be noted with regard to yields of wheat, as of all other grains, that official figures since 1933 are estimates of the crop prior to its harvest; harvesting losses, which are usually large in the USSR, are not taken into account, and the crop is therefore overestimated. A downward adjustment of the official figures is therefore necessary in order to make them at all comparable with USSR figures prior to 1933, or with those of other countries.

A classification, according to United States standards, of samples of 40 varieties of wheat considered representative of commercially important wheat in the USSR, indicated that 5 of these varieties were hard red spring wheats, 11 were hard red winter wheats, 9 were soft red winter wheats, 13 were durum wheats, and 2 were white wheats. Tests made by the United States Department of Agriculture indicated that:

> The hard red winter wheats had the best milling quality among the five classes of Russian wheats tested. . . . Next in order of merit were the durum wheats, followed by the soft red winter wheats and the hard red spring wheats. The samples of white wheats were not sufficiently large to make it safe to draw conclusions. . . . Baking strength of the flour milled from the durum wheats was, individually and collectively, excellent. . . . The baking data associated with the hard red winter wheat flours show that these flours were lacking in strength. . . . The baking strength of only two of the hard red spring wheat flours was sufficiently high to call them of good quality. Of the other three varieties, the baking strength of two was very poor and that of the third variety was somewhat below average. The baking qualities of the two white wheat varieties were above the average for this class of wheat. The poorest baking quality of all was associated with the soft red winter wheat flours. . . . If a comparison is made of the baking quality of these Russian varieties and those of similar classes grown in North America, it is apparent that only the Russian durum wheat varieties had as great baking strength as those varieties grown in North America. The Russian spring and winter wheats, in spite of their very high protein content, displayed weakness in baking strength too frequently to be called the equals of North American wheats.*

The important durum type of wheat mentioned above often also referred to as macaroni wheat because of its use in the manufacture of this and similar products, is entirely spring-grown. It is typical of southeastern USSR, from which it was introduced at the turn of the century into the United States. No separate statistics, however, have been available on durum wheat production in European USSR.

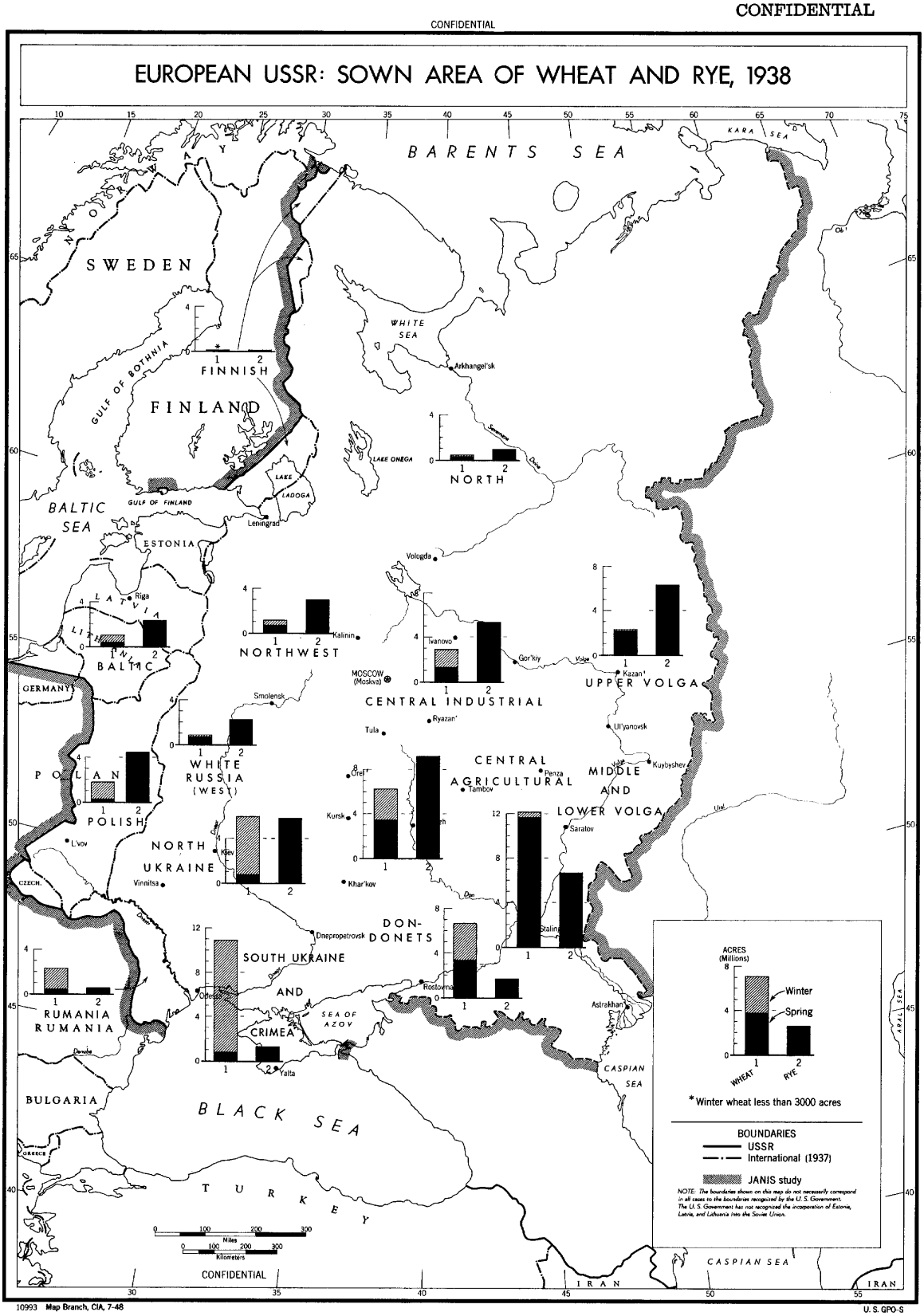
During World War II, the USSR winter wheat belt was almost entirely overrun by the Germans, who also made some inroads into the spring wheat belt in the direction of Stalingrad. Therefore wheat suffered especially severely as a result of the reduction of acreage which followed the invasion.

Not only in the invaded zone, but in the spring wheat belt of uninvaded USSR, a reduction of wheat acreage took place during the war, according to official statements. Since the end of the war, recovery of the spring wheat acreage has been emphasized by Soviet spokesmen and publications.

(b) Rye.—The crop that rivals wheat in the USSR is rye, which has always been an important bread grain in that country. From an historical point of view, it would be more correct to reverse the order and refer to wheat as a rival of rye, because prior to the 1930's the rye acreage exceeded that of wheat in European USSR proper. But during that decade rye was relegated to second place. In 1938 rye predominated over wheat in all the northern and central regions, and was nearly equal in acreage in northern Ukraine. There was a substantial rye acreage in the

* United States Department of Agriculture, Technical Bulletin No. 197, October 1930, *Milling and Baking Qualities of World Wheats,* pp. 151 and 157.

FIGURE IX-5
WHEAT AND RYE, 1938
JANIS 40
CONFIDENTIAL



Middle and Lower Volga region. Only in the extreme south was it insignificant (TABLE IX-12 and FIGURE IX-5). It has always been the leading grain in the Baltic and former Polish territories, but in the former Rumanian territories it was less than a fourth of the wheat acreage in 1938.

Just as wheat is the typical grain of the black-soil area, rye is the leading grain of the nonblack-soil area. But rye is regionally less concentrated than wheat and, except for the southernmost districts, is a significant crop in all regions of European USSR.

With insignificant exceptions, rye is a winter (fall-sown) crop. Usually it can be seeded earlier in the fall than winter wheat because of its immunity to the Hessian fly, which damages early fall-sown wheat. Rye is a more hardy winter crop than wheat, and can therefore be grown in the northern and eastern regions where climatic conditions make wheat production hazardous. While rye is sensitive to excessive heat and is not grown too far south, it stands spring drought much better than spring grains do. Rye is also an effective crop for weed control, which is so important in the USSR. These factors contribute to its wide use in the Soviet cropping system. Nevertheless, rye was losing in competition with wheat during the interwar period. In accordance with the Soviet policy, the wheat acreage was increasing, while the rye acreage was declining during the decade preceding World War II. Although no definite statistical information is available, there is reason to believe that rye acreage fared better than wheat during the war years, but the resumption of the former downward trend during the postwar period is probable.

(c) Oats.—The grain crop next in importance to wheat and rye is oats. Oats acreage is third in European USSR proper, first in Latvian SSR and the former Finnish territory, and shares first place with rye in Estonian SSR. It was second in importance in the former Polish and East Prussian territories, and only in the former Rumanian territories was the acreage under oats insignificant (TABLE IX-11).

In European USSR proper, oats is fairly widely distributed, except in the more southern and dry regions, where it is replaced by the more drought-resistant barley. The most important oats regions, however, are the Central Industrial, Central Agricultural and Upper Volga, accounting for nearly 60% of the total 1938 oats area of European USSR proper. Oats holds second place in the sown area of the northwest and is the leading crop in the north, exceeding rye. It is also important in north Ukraine (TABLE IX-12). Oats is entirely a spring-sown crop.

Oats is predominantly a feed crop and the amount used for human consumption is normally insignificant. The great reduction in the number of horses (the principal consumers of oats), which took place in the 1930's, led to a decrease in the acreage under this crop, although not to a great degree, because of the established position of oats in the system of crop rotation. The acreage under oats decreased considerably between 1928 and 1938 in the Central Agricultural, and Upper Volga regions, and in the South, but oats held its own in other regions, and even increased considerably in the Middle and Lower Volga, despite reduction in the number of horses.

Since the war sizable quantities of oats have been used for the manufacture of alcohol, and as cereal and flour for human consumption.

(d) Barley.—Barley was a much more important crop in Russia before World War I than during the subsequent years. Before 1914 it rivaled wheat in importance as a leading export grain. The acreage, production, and exports of Russian barley declined considerably during the interwar period. Only some 20 million bushels were exported on the average during the five years ending 30 June 1938, as compared with exports prior to World War I of over 170 million bushels, most of which originated in the territory of European USSR proper.

The growing of barley is highly concentrated, and most of the acreage is found in the south (TABLE IX-12). But barley adapts itself to varying climatic conditions, and is relatively even more important in the far north than in the south. Thus, in Odesskaya Oblast' in the Black Sea littoral, barley, in 1938, occupied 15% of acreage as compared with 39% for winter wheat, the leading crop in this region. At the opposite extreme, in Arkhangel'skaya Oblast' the northernmost agricultural region of the USSR, barley accounted for 19.1% of the acreage as compared with 22.4% for oats and 22.8% for winter rye.

With insignificant exceptions, barley is spring-sown in European USSR (TABLES IX-10 and IX-11). Only spring varieties of barley show the great adaptability to climatic extremes, which makes it possible for them to grow from the Black Sea littoral to beyond the Arctic Circle. Winter (fall-sown) barley is not hardy enough to withstand severe winters and can be grown only in regions with mild winters. In this respect it is inferior to rye and even wheat. Only in the extreme south, in the Crimea, was there a significant acreage under winter barley before World War II. Wherever it can be grown, winter barley is a valuable crop in a rotation system, because it is seeded later in the fall than winter wheat, and can therefore follow a late maturing crop such as cotton; it is also the earliest crop harvested, thus permitting the planting of another summer crop or of winter grain.

Barley is primarily a feed grain, valuable because of the high protein content of most of the USSR crop. It is, however, less exclusively used for feed than oats. Of the total rural consumption in 1926-27 nearly four-fifths was for feed and one-fifth for food. But in the more northern regions the food use of barley exceeds that as feed. No similar breakdown is available for urban consumption, in which food, feed, and industrial uses of barley by the civilian population and the army are lumped together. Barley is a source of grits (porridge), and in the north and northwest, bread is made of barley flour, which is sometimes also mixed with rye and oats.

Uniform and well-matured grain, with a moderate protein content, is required for beer-making purposes. These qualities are met by barley grown under sufficiently humid conditions in the western regions of the country, while most of the barley grown in the south is unsuitable.

Although barley is grown predominantly in the part of the country that was invaded by the Germans, its recovery has been more rapid than that of many other crops. It was stated by a high Soviet official that the 1946 barley acreage in the Ukraine exceeded prewar.

(e) Corn.—The minor role which corn plays in the USSR constitutes, perhaps, the most striking difference between the agricultural pattern of that country and the United States. Corn is a major crop only in the former Rumanian territory (where before the war it accounted for nearly a third of the acreage and is the staple article of the population's diet). The small corn acreage of European USSR proper (about 3.3 million acres) is concentrated in the southern part of the country, nearly half of it in the southern Ukraine and Crimea. Even in the latter region, corn constitutes only 6% of the total crop area (TABLE IX-10 and IX-11).

The acreage trend was downward before World War II. The 1938 corn acreage in the Ukraine was only a little over 40% of that in 1928. The yields were said to have been increased considerably during the years 1936-40, but a sharp reduction in yields has been reported since the war, due to the deterioration of the agricultural technique, a great decrease of selective seed plantings, and increased corn diseases and pests. Since the end of the war, effort is being made to restore corn cultivation. But the large amount of labor involved in growing corn by hand methods is a handicap to corn culture during the early postwar years, when mechanization is at a low ebb and there is an acute shortage of animal draft power. Even before the war, an acre of corn in southern Ukraine required 7.4 to 8.5 man-days of labor, which is much higher than in any section of the United States except New England.

(f) Other grains.—Millet and buckwheat play a significant part in the Russian diet as sources of porridge *(kasha)*. In 1938 they occupied in European USSR proper 5.8 and 4.1 million acres, respectively (TABLE IX-10).

Because of its short vegetation period, buckwheat can be cultivated quite far north, despite its sensitiveness to spring frosts. It is also not an exacting crop as far as soil is concerned. Buckwheat is grown primarily in the central regions and in the northern Ukraine. Because of its sensitiveness to drought, the effort to extend it eastward and southward was not successful. The southern frontier of buckwheat cultivation follows the line Vinnitsa—Voronezh—Penza—Kazan'. The yields of buckwheat have been rather low and unstable.

Millet acreage is concentrated in the Middle and Lower Volga and Central Agricultural regions, and throughout the south, extending into the extreme south. Unlike buckwheat, it is an excellent drought-resistant crop. Since millet can be planted late in the season, and requires little seed, it is considered an important "insurance" crop in the semiarid zone of the USSR, providing a source of food and feed when other grain crops fail. A serious disadvantage of millet is the necessity of extensive weeding and consequently large labor requirements. The government has paid considerable attention to the millet crop during the past decade and encouraged its planting and better farm practices to improve the rather low yields per acre.

Such leguminous crops as peas, lentils, etc., are included in Soviet statistics with grain crops. An area of 4.9 million acres was occupied by grain legumes in 1938 in European USSR proper. A little over a half of this acreage was under peas. The Central Agricultural region, Upper Volga, Middle and Lower Volga, and Northern Ukraine, are the regions were practically all of these grain legumes are grown. Very little of the acreage is located north or south of these regions. Planting of these leguminous crops, which not only provide valuable food and feed rich in protein but also enrich the soil with nitrogen, is now encouraged by the Soviet Government.

(3) Potatoes

Next to wheat and rye, potatoes constitute the most important food crop in the European USSR. In 1938 potatoes accounted for only about 7% of the sown area in European USSR proper (TABLE IX-11), but they were of much greater importance in the western and central regions, in which over half of the acreage was concentrated, and of less importance in the east and south (TABLE IX-12). In a region like White Russia (West), nearly a fifth of the acreage was devoted to potatoes. Northern Ukraine also had a sizable potato acreage, but in southern Ukraine the potato area was relatively insignificant. In the former Polish provinces, 15% of the sown area was occupied by this crop and in the Baltics nearly 8 percent. Few potatoes, however, were grown in the former Rumanian provinces.

Yields per acre were generally higher in the newly incorporated territories, particularly in the Baltics, than in European USSR proper (TABLES IX-13 to IX-17), though they were increasing in the latter before the war. The yields were particularly low in the southern regions, where the high temperature of the soil during the period of development has an adverse effect on tubers. Widespread virus diseases, resulting in the degeneration of the potato culture within two or three years, in the southern steppe regions makes it necessary to bring seed potatoes from northern or mountainous regions.

Summer planting of potatoes in the south at the end of June or the beginning of July was introduced before the war in order to postpone the period of tuber development until September when the temperature is lower and the humidity greater. In 1938 nearly 116,000 acres of potatoes were planted in the summer in European USSR proper.

Although the use of potatoes for feed in the USSR was less prevalent than in western Europe, particularly Germany, over a fourth of the crop was used for feed in the USSR, according to the data available for the years 1925-26 and 1929-30. The per capita food consumption of potatoes was much larger in the northern and western parts of the country, where potatoes are largely grown, than in the south and east. Thus, the food budget surveys for the years 1925 through 1927 showed 540 pounds per capita consumption of potatoes in the so-called consuming, or grain-deficit area, which includes roughly the Northern, Northwestern, Western, Central Industrial, and part of the Upper Volga regions. In the so-called producing, or grain-surplus area, which included the Central Agricultural, Middle and Lower Volga, and South, as well as Siberia, the average per capita consumption of potatoes during the same period was 336 pounds. In Germany in the 1930's it was 417 pounds.

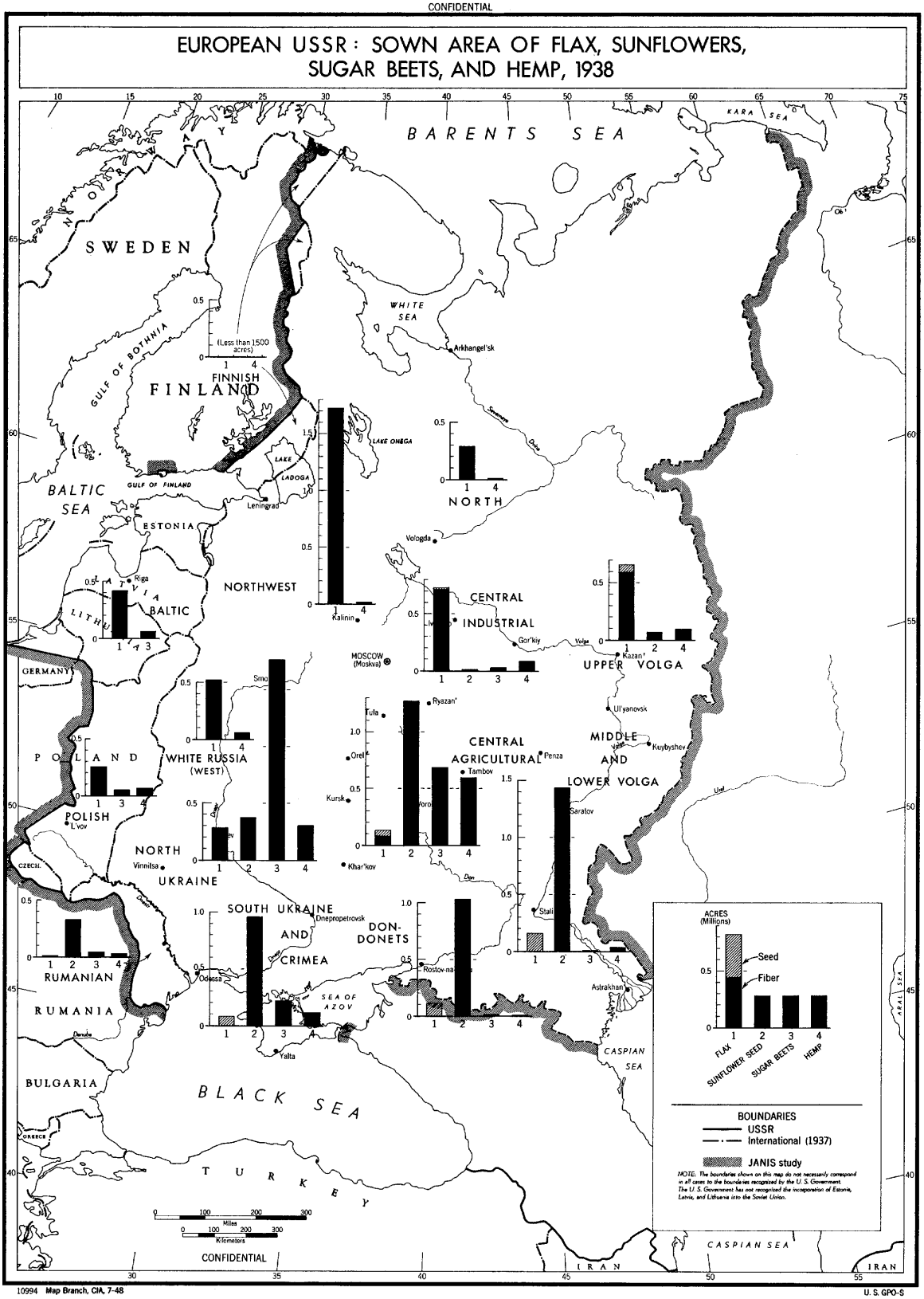
Before World War I, potatoes were used extensively for the production of alcohol, but during the interwar period grain was substituted to a considerable extent for this purpose. The use of potatoes as a source of alcohol, however, began to increase again before the war. In 1937 potatoes constituted only 15% of the total raw material used in the alcohol industry, and grain 70%; the plan for 1938 called for 23% and 57% of potatoes and grain, respectively.

The war has greatly enhanced the importance of potatoes because of the large outturn in terms of calories per acre. Even in the invaded regions, their acreage decreased relatively less than that of other crops; in the uninvaded regions, potato acreage has expanded considerably since the war. Potatoes became the principal crop on the numerous victory gardens of the urban dwellers, the acreage of which increased from 1,500,000 acres in 1940 to 2,750,000 acres in 1944. Still, in 1946, the potato acreage of the whole USSR, including the uninvaded European and the Asiatic regions, was 86% of the estimated 1938 acreage. The decline was probably greater for European USSR alone.

(4) Sugar beets

The sugar beet is the only domestic source of sugar in European USSR, although a little sugar cane is grown in Central Asia. Since it is also a highly intensive crop with a large labor expenditure and high return per acre, it is

FIGURE IX-6
FLAX, SUNFLOWERS, SUGAR BEETS, AND HEMP, 1938
JANIS 40
CONFIDENTIAL



of greater importance in the economy than is suggested by the size of the area on which it is grown. The 2,841,800 acres sown to this crop in 1938 accounted for only 1.1% of the total sown area; in European USSR proper the percentage was 1.2 and in the acquired regions only 0.3. More than 90% of the sugar beets are grown in the Central Agricultural and Northern Ukrainian regions. This localization is in great part due to the special requirements of sugar beet growing (TABLES IX-10 to IX-12 and FIGURE IX-6).

Fertile soil, or well-fertilized soil, and intensive cultivation, requiring much labor, are needed to obtain high yields of sugar beets. The history of sugar-beet culture in the USSR demonstrates the difficulties which have been encountered in meeting these requirements. The area under sugar beets in European USSR proper increased markedly in the late 1920's and early 1930's, after which it declined. Sugar-beet yields fluctuated: during the period 1925-29, the average yield was 5.6 short tons per acre, but in the next five years, when agriculture was being extensively collectivized, the yield dropped to an average of 3.7 short tons per acre. In the middle 1930's, special efforts were made by the government to improve cultural practices and increase their mechanization, with some improvement in the yield. The average for 1935-39 was 6.1 short tons per acre.

The most important sugar-beet regions were invaded during the war. The devastation by the Germans, the destruction of machinery and the inability to replace it, the disruption of crop rotations, the infestation of weeds, and the lack of necessary manpower during the war, have had the most serious effects on sugar-beet production. While in some places in European USSR sugar-beet acreages have been restored to their prewar levels, the over-all acreage is still below prewar and yields are estimated to have recovered even less. The estimates for the whole USSR (1938 boundaries) for 1946 are: 2,584,700 acres, a yield of 5.1 short tons per acre, and production 13,260,000 short tons, as compared with the 1935-39 averages of 2,970,000 acres, 6.1 short tons per acre, and 18,201,000 short tons total.

The sugar industry also suffered severely from the destruction of refineries. Great efforts have been made to repair the damage. As a consequence, in 1946, 100 sugar refineries were operating in the Ukraine alone, as compared with 160 before the war. Over all of the USSR, the total number of refineries in operation at the end of 1946 was 186, as compared with 158 the preceding year.

In the years 1934-38, the USSR was on an export basis and net exports of sugar and processed sugar products averaged 105,616 metric tons (116,421 short tons). The war reversed this situation and necessitated severe rationing of sugar.

During the 1930's sugar-beet production was expanded in Latvia and Lithuania. In Latvia, the average acreage for 1935-39 was 33,000 acres with a production of 282,000 short tons of sugar beets. The comparable figures for Lithuania were 20,000 acres and 168,000 short tons. In both countries, the yields — 8.5 and 8.4 short tons per acre respectively — were higher than the average yield for the whole USSR during 1935-39. Sugar-beet growing in the Baltics suffered severely during the war. The fragmentary data available suggest that, as in the rest of the USSR, great efforts are being made to recover these production losses.

In other territories acquired by the USSR, the sugar-beet crop was an even smaller proportion of the sown area. In 1938 it amounted to less than half of one percent in the Rumanian territory, about a quarter of one percent in the Polish provinces, and only two-tenths of one percent in the Königsberg (now Kaliningrad) region of East Prussia. The yields obtained that year were 8.3 short tons per acre in the Rumanian territories, 7.9 short tons per acre in the Polish provinces, and 12.8 short tons per acre in East Prussia, where agriculture was at a higher level.

In 1938 the total area under sugar beets in the acquired territories was 133,600 acres with a production of 1,064,100 short tons.

(5) Sunflower seed

Sunflower seed is the principal oil crop in the USSR which before the war produced almost 80% of the world crop. Almost the entire crop is found in the Central Agricultural, Middle and Lower Volga, and Southern regions of European USSR, and it is domestically consumed. In the newly acquired territories, sunflowers are important in the former Rumanian provinces, where likewise they are the chief oil-bearing crop, occupying an even larger proportion of the cropland (TABLES IX-10 to IX-12; also FIGURE IX-6).

The plant is well suited to the USSR as it is rather hardy and drought-resistant. Successful efforts were made before the war to breed high-yielding, rapidly maturing varieties to avoid the great losses from frost and snow.

In the Soviet Union, sunflowers are profitably used from stalk to flower. Oil from the seeds is the basic vegetable oil for food; oil cake is valuable feed concentrate; and the remaining part of the flower can be used as a coarse fodder after threshing. The husk of the flower is used for fuel, and the ashes of the stalk are a source of potassium carbonate. In the principal producing regions, whole sunflower seeds are eaten like peanuts and constitute a popular delicacy.

The 1933-37 average production of sunflower seed in European USSR proper was nearly one and a half million short tons (TABLE IX-13), with a yield of only 0.26 short tons per acre. The 1938 production in the Rumanian territory was 152,100 short tons, with a yield of 0.46 short tons per acre. During the war sunflower production in the USSR was reduced because, to a large extent, the crop lay in the path of the invasion. Great efforts have been made to recover these losses. There has been more success in reestablishing the sown area than the yields. Large harvest losses were reported in 1945.

(6) Flax

Flax is one of the most important industrial crops in the European USSR. Fiber for linen fabrics is obtained from its stalk. Its seed is a source of linseed oil, which is used as a drying oil and also, after refining, as an edible oil, or for the manufacture of such products as margarine. The oil cake remaining after the extraction of oil is a valuable feed concentrate. Different varieties of flax are planted, depending upon whether it is grown primarily for fiber or seed. The fiber varieties, of course, also produce some seed, but the yield of the latter is considerably smaller than of the specialized seed varieties. There are also important differences in climatic conditions required for the best growth of fiber and seed varieties of flax. The former require a humid climate with moderate summer temperature, whereas the latter grow better in regions with warmer and drier weather.

Unlike the United States and Argentina, where flax is primarily grown for its seed, European USSR produces it principally for fiber. In European USSR proper, exclusive of the newly acquired territories, 4,220,000 acres were sown in 1938 to fiber flax, and 462,000 acres to flax grown only for its seed (TABLE IX-12 and FIGURE IX-6).

The growing of fiber flax is centered in the western regions of European USSR (Northwestern and White Russia), in the Central Industrial Region, and the Upper Volga. The Middle and Lower Volga and the southern regions of the country lead in flaxseed acreage. Of the 666,000 acres of flax in 1938 in the acquired territories, a little more than 60% were in the Baltic republics, which also specialized in fiber flax. The yields per acre of both fiber and seed are higher in the acquired territories than in European USSR proper. The highest yields are shown by Lithuanian SSR (TABLE IX-13 to IX-18).

It was customary for the Soviet peasant farmers to plant flax as late as June, but planting early in May is recommended by Soviet agronomists as advantageous to yields and to the quality of the stalk. It is characteristic of flax, even more than of many other crops, that growing it continuously on the same land is detrimental to yields. Even a generous application of fertilizer does not remedy the situation, as some of the deterioration in yields may be due to the prevalence of soil fungous diseases. Rotation of flax with other crops, therefore, is essential for maintenance of yields. Clover is considered one of the best predecessors for flax as it enriches the soil with nitrogen in proper proportion, maintains good structure of the soil and keeps it clean of weeds. The development of flax-growing, therefore, in the principal regions of the USSR was accompanied by the expansion of the area under clover. In 1936, 26% of the flax-fiber area was preceded by clover, and 43% by winter grains, which in turn were usually preceded by a fallow. Successive planting of flax had become insignificant before World War II.

Considerable effort was made before the war to mechanize various operations connected with flax production and processing, which require a great amount of hand labor. Especially was this true of hand harvesting (pulling) of flax. On 1 January 1939, there were over 9,000 pulling machines and 800 threshing machines of Soviet make being used in harvesting of flax in the USSR. In 1938 nearly 80% of the flax acreage was seeded with selected seed. The quantity of commercial fertilizer used was also increasing from year to year. However, the increase in the yields of flax of about 13% on the average during 1933-37, compared with 1928-32, had not been considered satisfactory by the government. The third Five-Year Plan, which was approved in 1939, called for an increase of over 75% in yields per acre as compared with the 1933-37 average.

Russian flax was an important article for export during the 19th and early years of the 20th century. In fact, prior to World War I, Russia was the leading exporter of flax and tow in the world. These exports declined greatly during the interwar period. They averaged only about 5,000 short tons during 1935-38, as against more than 300,000 short tons in 1913. (The figure for 1913 includes exports from the Baltic States, at that time a part of Russia. The average for 1935-38 does not include the Baltic States, which exported on the average over 30,000 short tons.)

Flax production suffered tremendously during the war. Large stretches of the most important flax-growing regions were invaded by the Germans, who caused great damage to the collective farms and the machine-tractor stations. The example of the Smolensk province (Northwestern region) shows the extent of acreage decline. In 1940, over 500,000 acres were devoted to fiber flax in that province, and less than 200,000 acres in 1945, after the province was liberated and recovery ensued. In the uninvaded regions, flax production has been handicapped by shortages of labor and draft power, fertilizer, and the difficulties of adequately replacing and repairing machinery. For all these reasons both acreage and yields of flax were greatly reduced. The 1946 flax acreage was less than half of prewar.

(7) Hemp

Before the war the USSR was also a leading producer of another fiber and oilseed crop — hemp. Hemp seed yields valuable oil and cake for fodder; the stalk yields a fiber used in the manufacture of such durable cloth as canvas, bagging, sailcloth, and rope.

In European USSR, two kinds of hemp are grown: the middle-Russian, or northern, hemp, accounting in 1938 for two-thirds of the total acreage, and the more recently introduced Italian hemp, also known in the USSR as southern hemp. The latter has a longer growing period, 100-110 days, by comparison with 80-90 days for middle-Russian or northern hemp. The fiber of the southern hemp is of superior quality and is sometimes used as a substitute for flax. While the yield of fiber is higher for southern hemp than for the northern variety, the reverse is true of seed. The seed of southern hemp, grown in Central Russia, does not usually mature. Thus, the middle-Russian or northern hemp can be said to be a dual-purpose crop, grown both for fiber and for oil, while the southern hemp is primarily a fiber crop.

The middle-Russian or northern hemp is grown widely in the European USSR. It is concentrated especially, however, in the Central Agricultural Region, the Northern Ukraine (Chernigovskaya Oblast'), and in the southwestern corner of the Ukraine. Southern hemp is grown largely in the Central Agricultural Region and in the central and southern Ukraine (TABLE IX-12 and FIGURE IX-6).

Hemp is entirely a spring-sown crop. The period between 1 May and 20 May is normally recommended for planting. June plantings give poorer yields.

Hemp, which is highly responsive to fertilizer, has usually been grown on abundantly manured plots of land devoted exclusively to the raising of this crop. Without application of fertilizer, low yields are obtained even on the fertile black soil. In addition to the use of fertilizer, it is recommended that hemp be planted in rotation with a legume grass, like clover. The need of specially prepared land presents an obstacle to a rapid expansion of the area under hemp, which, in fact, declined during the 1930's after reaching a peak in the early years of that decade. Hemp, unlike other crops, continued to be grown to a considerable extent by farmers individually, even after collectivization. The old hemp land, which was included with the individual kitchen garden plots on collective farms, continued to be used for this purpose.

Before World War I, Russia shared with Italy the leading place as supplier of hemp fiber to the world industry. But during the interwar period, Russian hemp fiber exports dwindled to insignificance. Hemp seeds have not been exported since 1934.

The Soviet Union, it is estimated, produced, prior to the war, about three-quarters of the world crop of hemp seed and between a quarter and a half of the world's hemp fiber. Both Poland and Rumania were also relatively large producers. Approximately three-quarters of the Polish and one-fifth of the Rumanian hemp areas were located in territories recently acquired by the USSR. This suggests that, when the ravages of war have been overcome, the USSR will continue to be by far the largest world producer of hemp seed and fiber.

Since the war, hemp production in the USSR, although apparently somewhat less emphasized than flax production, has been the object of efforts toward improvement, initially toward the reestablishment of prewar acreages and yields, which were drastically reduced in wartime. In 1945, the acreage goal planned for the crop was increased, but the plan was not fulfilled, and severe harvesting losses were reported. In 1946, the acreage plan was again increased and the few reports of both sowings and harvesting were more favorable. But the 1946 hemp acreage was still only about 40% of the prewar. The Five-Year Plan for 1946-50 envisages hemp acreages and production in excess of prewar levels.

(8) Cotton

During the 1930's cotton, which up to that time was grown in the USSR only in the irrigated regions of Central Asia and Transcaucasia, was introduced into southern European USSR. In 1938, 564,600 acres (228,500 hectares) were planted to cotton in the southern Ukraine, 123,800 acres (50,100 hectares) in the Crimea, 35,800 acres (14,500 hectares) in Rostovskaya Oblast', and 4,900 acres (2,000 hectares) in the lower Volga area (Astrakhanskaya Oblast').

This innovation meant the movement of cotton northward, and its cultivation under less favorable climate and under dry-farming (nonirrigated) conditions. The crop, which requires a long growing period free from frosts, was often damaged by early frosts in these regions. The cotton yields were very low, the quality inferior, and the cost high. Practically all this cotton area was in the zone which was occupied by the Germans during the war, and little if any cotton was produced during the occupation.

Judging from the production program of the Five-Year Plan announced in the spring of 1946, there is no intention to resume cotton growing on the former large scale in these relatively low-yielding, high-cost regions. Shortage of manpower in this war-ravaged area may have had an important bearing on the decision to reduce the acreage under cotton, which requires considerable labor expenditure per acre.

(9) Tobacco

Two kinds of tobacco are grown in the European USSR, 1) the so-called yellow tobacco, which is predominantly a cigarette leaf, and 2) a low-grade, coarse, strong tobacco, high in nicotine content, which is called makhorka. The latter is used both for smoking and for extraction of nicotine for insecticides. In 1938 the total area under yellow tobacco in European USSR proper amounted to 66,200 acres, of which northern Ukraine accounted for 18,800 acres and the Crimea 21,700 acres. Tobacco culture in the Crimea is 200 years old, and some fine leaf of the oriental, or Turkish, type is grown in that region.

In 1938 an area of 233,500 acres was planted to makhorka, of which the Ukraine accounted for 94,900 acres, Middle and Lower Volga for 40,300 acres, and the Central Agricultural region for 48,900 acres. While most of the makhorka acreage is in European USSR, some of the most important yellow-tobacco-producing regions are in the Caucasus.

The acreage and production of both yellow tobacco and makhorka were greatly reduced during the war. The tobacco area in the Crimea in 1944 was only 3,645 acres as compared with nearly 22,000 acres before the war. The yield per acre was only 294 pounds as compared with 758 pounds in 1939. An improvement in the Crimea occurred in subsequent years. Makhorka acreage is being restored more rapidly than yellow tobacco. In the Ukraine, tobacco acreage in 1946 was 58% of prewar and makhorka nearly 83 percent.

B. Livestock

The livestock industry of European USSR proper has passed through several phases of decline and recovery since World War I. Between 1916, when the first Russian census of livestock was taken, and 1922, livestock numbers declined. This was the period of revolution, civil war, and famine.

Between 1922 and 1928, a recovery took place and livestock numbers generally exceeded the 1916 level. Another decline took place in the early 1930's during the collectivization campaign, when the peasants (who were joining the collective farms or who were being liquidated as independent farmers) slaughtered their livestock on a huge scale. Poor husbandry in the new collective and state farms, and shortage of feed, contributed to excessive mortality of livestock.

In the Ukraine livestock numbers decreased as follows between June 1928 and 1933: all cattle 48%, cows 40%, hogs 70%, sheep and goats 75%, and horses 53 percent. For White Russia the percentage reduction for the same period was: all cattle 29%, cows 24%, hogs 35%, sheep and goats 52%, and horses 27 percent. After the middle 1930's, with governmental encouragement of individual ownership of livestock (except horses) by members of collective farms, a recovery again took place. But in 1938, as far as it is possible to judge from available data, livestock numbers were still below the 1928 level in European USSR proper, except hogs which were substantially above.

The great decrease in the number of horses in the 1930's was offset by the introduction of tractors, but it was never part of the government program to permit so serious a reduction. On the contrary, the need to increase the number of horses was frequently stressed in government decrees and pronouncements.

A new decline took place as a result of the war and particularly of the destructive German occupation. By the end of 1945, when some recovery already had taken place, cattle numbers for the Soviet Union as a whole were 80% of the 1938 figure, horses were a little more than half, and hogs only a third of the 1938 numbers. For the European USSR alone, which includes the whole of the invaded area, the decline was probably greater. Collectivized livestock suffered especially during the German occupation.

Horses were collectivized with minor exceptions, but most other livestock before the war was individually owned. In the Ukraine, out of 2.9 million horses on 1 January 1938, only a little over a hundred thousand (including city horses) were individually owned and the rest were either on collective or state farms or institutions. However, of the 7.8 million head of cattle, nearly 5.4 million were individually owned; of the 7.7 million hogs, 5.1 million were individually owned. In White Russia, out of more than 600,000 horses, only about 70,000 were individually owned; out of 1.9 million head of cattle, over 1.1 million were individually owned; out of nearly 2 million hogs, 1.7 million were individually owned. Other regions would show a rather similar proportion.

Between 1939 and the beginning of war, a strong effort was made by the Government to increase the communal herds (collectivized livestock). An important step in this direction was the change in the basis of compulsory deliveries of dairy and livestock products. After 1940 the collective farms were required to deliver a certain quantity of livestock and dairy products per unit of land instead of

TABLE IX - 21

LIVESTOCK NUMBERS, TOTAL AND PER 100 ACRES OF SOWN AREA, EUROPEAN USSR, 1938

Region	Total livestock (thousands)				Livestock per 100 acres of sown area			
	Horses	Cattle	Sheep	Hogs	Horses	Cattle	Sheep	Hogs
European USSR proper: *								
North	460. 1	1, 221. 4	779. 6	220. 3	11. 4	30. 2	19. 3	5. 4
Northwest	1, 135. 4	2, 765. 9	3, 063. 6	1, 885. 0	7. 7	18. 8	20. 9	12. 8
Central Industrial	1, 312. 8	3, 144. 8	3, 921. 3	1, 863. 2	5. 5	13. 1	16. 3	7. 7
Central Agricultural	1, 451. 4	3, 480. 9	3, 617. 9	2, 471. 8	4. 0	9. 6	9. 9	6. 8
Upper Volga	940. 2	1, 968. 9	2, 798. 9	1, 079. 5	4. 8	10. 0	14. 2	5. 5
Middle and Lower Volga	603. 4	2, 824. 1	4, 259. 9	965. 7	1. 9	9. 0	13. 6	3. 1
South	3, 242. 1	9, 174. 4	4, 984. 0	8, 422. 8	4. 2	11. 9	6. 5	10. 9
North Ukraine	1, 872. 6	4, 647. 8	1, 033. 9	4, 845. 8	5. 7	14. 2	3. 2	14. 9
South Ukraine and Crimea	895. 0	2, 551. 9	2, 122. 7	2, 218. 9	3. 4	9. 8	8. 1	8. 5
Don-Donets Region	474. 5	1, 974. 7	1, 827. 4	1, 358. 1	2. 6	10. 7	9. 9	7. 3
West	632. 9	1, 905. 3	1, 055. 9	1, 951. 0	7. 7	23. 1	12. 8	23. 7
All European USSR proper	9, 778. 3	26, 485. 7	24, 481. 1	18, 859. 3	4. 5	12. 3	11. 3	8. 7
Newly incorporated areas:								
Finnish	43. 0	195. 0	108. 0	68. 0	6. 9	31. 2	17. 3	10. 9
Baltic**	1, 168. 7	3, 049. 4	3, 251. 4	2, 384. 7	9. 1	23. 8	25. 3	18. 6
Königsberg***	174. 0	554. 0	39. 0	712. 0	12. 2	38. 9	2. 7	50. 1
Polish**	1, 629. 8	4, 098. 3	2, 371. 6	2, 696. 4	10. 1	25. 5	14. 7	16. 8
Rumanian†	602. 8	734. 3	2, 400. 3	610. 7	7. 6	9. 2	30. 1	7. 7
All European USSR	13, 396. 5	35, 116. 7	32, 651. 4	25, 331. 1	5. 3	13. 8	12. 8	9. 9

* Data are for 1 January 1938.
** Data are for June 1938.
*** Data are for December 1936.
† Data are for summer 1935.

per head of livestock. It was essential for the collective farms to increase their communal livestock numbers in order to comply with this requirement.

As far as regional distribution of livestock in European USSR proper is concerned, northern Ukraine had, in 1938, the largest number of horses, cattle, and hogs; it was followed by the Central Agricultural Region. In sheep, the Middle and Lower Volga was leading, followed by the Central Industrial Region. A somewhat different picture, however, is presented when livestock numbers are related to acreage. The northern and western parts of European USSR proper had the largest number of cattle per 100 acres. Here in the proximity of the two largest cities, Moscow and Leningrad, is the dairy-farming region of European USSR. Incidentally, the famous Cholmogor dairy cow is a native of the far north, Arkhangel'skaya Oblast' (TABLE IX-21).

White Russia (West) had 37% more hogs per 100 acres than northern Ukraine, which leads in the total number of hogs. In the number of sheep per 100 acres, likewise the northern regions led, and not Middle and Lower Volga with their largest absolute number. In the case of horses, relative to acreage, the northern regions are also ahead of the Central and especially the Southern regions with their high degree of mechanization. Livestock is essential for farming in the more northern parts of European USSR also because without manure crop production is impossible on the infertile soils of these regions.

The number of animals per 100 acres is considerably larger for all types of livestock in the newly incorporated areas (with the exception of the former Rumanian territory) than in European USSR proper. Dairy farming and pig raising were of importance in the Baltic republics, which were substantial exporters of butter, particularly Latvia, and of hog products and live pigs, especially Lithuania.

C. Food consumption and distribution

European USSR as a whole is normally self-sufficient with respect to most foodstuffs and even had small export surpluses. Before World War II European USSR proper exported small quantities of wheat, rye, barley, and oats, oilseeds, and sugar. The Baltic Republics also exported small quantities of grain and substantial quantities of butter and hog products. The former Rumanian territory exported wheat, corn, oilseeds, and some fruit.

As could be expected of an area of the size of the European USSR and with its variety of natural and economic conditions, there are considerable regional differences with respect to self-sufficiency in the matter of food supply. The pattern is most definitely established for grain, which is the most important article of the Russian diet. The country is broadly divided into a grain-deficit area, which roughly corresponds to the zone of nonblack soils, and a grain-surplus area, embracing for the most part the black-soil zone. The South, the Middle and Lower Volga, the Central Agricultural region, and part of the Upper Volga fall within the grain-surplus area, and so do the Baltic and former Rumanian territories and the southern part of the former Polish territories. The rest of the country is the grain-deficit area.

(1) Consumption

Data on Soviet food consumption were provided by special food surveys, the results of which, however, are not available beyond 1928. At that time the average caloric intake amounted to roughly 3,000 calories. Breadstuffs greatly predominated in the Soviet diet, accounting, even in normal years, for over 80% of the caloric intake. While no independent statistical data on food consumption were published in the 1930's, there is good ground for believing, from both production statistics and reports of observers, that the Soviet diet deteriorated. This deterioration was

especially great during the early 1930's, when the rural population actually suffered from starvation, while the urban population was subjected to severe rationing. But even in the late 1930's, conditions were less satisfactory than they were in the middle 1920's, especially in meat and dairy products; the country still felt the adverse effect on the livestock industry of the agricultural collectivization in the early years of the decade. A further deterioration of the Soviet diet, especially in nonbread components, has taken place since the war. This subject can be best dealt with in conjunction with rationing, which will be discussed in connection with the general problem of distribution of foodstuffs.

(2) Distribution system

The foodstuffs grown on the three types of farms (collective, state, and independent) reach the ultimate consumer by various complicated routes over which the state has almost complete control.

(a) Producers' outlets.—Basic to collective and state farming in the USSR is the entry of the state into the distribution system as a principal buyer, regulating prices directly and indirectly. The government is the direct recipient of farm produce in four ways. First, all farms are required to deliver to the state, at low fixed prices, a portion of their crops and livestock produce, based on the size of their land. Second, the state, as owner-manager of the machine-tractor stations, receives the produce paid to these stations by the collective and state farms which they service. The proportions of the collective farm produce delivered to the state in these two ways varies. In 1937, compulsory deliveries of the grain crop of collective farms amounted to 12.2% and payments in kind to machine-tractor stations to 13.9 percent. In 1939 the respective shares of a smaller crop increased to 14.3% and 19.2% of the crop. The third direct means by which the government obtains agricultural commodities is through sale to the government, by collective farms and their members, in excess of their quotas, at prices somewhat higher than those paid for compulsory deliveries. Finally, the supplies produced by the state farms are at the disposal of the government.

Collective farms have other, less rigidly restricted outlets for their produce on the free, open markets or bazaars in cities, towns, and villages. Likewise, members of collective farms and the few remaining independent farmers may sell in such markets the produce from their own gardens, or the surplus from their wages in kind.

These sales are necessarily limited by such factors as transportation (since railroads could not be used for food shipment, except by passengers carrying it as their personal baggage), by the prohibition of the services of middlemen who are labeled in Soviet parlance as speculators*, and by state ownership of most processing plants. Finally, the surpluses available for sale on the free market, after meeting government deliveries and consumption requirements, are not large.

Prices in these open markets are largely the result of supply and demand, although the government exercises some control indirectly by the competition of its "commercial" stores, where food is sold at high prices and without the requirement of ration coupons. During the winter of 1943-44, when the deprivations of war were at a maximum, prices on these open markets were at their highest and much of the trade was on a barter basis.

* "Speculation" is a criminal offense, and "speculators" at these markets may be arrested by the police. Nevertheless, there have been reports of considerable activity by "speculators" in periods of widespread shortages, such as those of 1946-47.

(b) Distribution to consumers.—Since 17 July 1941 the Soviet Union has rationed the basic foods to all nonagricultural producers. Unrationed self-suppliers have a less privileged position than that of most agricultural producers in other rationed countries, because the system of planned production, compulsory deliveries to the state, and residual payments to collective farmers, acts as a sort of rationing.

The rationed population, exclusive of the armed forces, is divided into the following six categories:

R-1 Card is for workers in heavy industry, such as metallurgy, machinery industries, etc. It is understood that in many cases miners receive a super-ration which is larger in terms of bread than an R-1.

R-2 "Worker's card" is given to outdoor workers doing manual labor or work requiring considerable amounts of exercise. It is also given to indoor workers and executives with special qualifications (such as a higher education), and to students in higher educational institutions. A special variation of this card exists for engineering and technical workers.

S-3 "Employee's card" is held by almost all workers not receiving R-1 or R-2. It is particularly for indoor and office workers without highly specialized qualifications.

I-4 "Dependent's card" is held by adults (persons over 18) who are unemployed and at the same time are in one or more of the following groups: a) invalids of the first or second categories; b) mothers with children under eight years of age; c) women over 55; d) men over 60.

IT-4 "Dependent's card" for all unemployed adults, including housewives who do not receive I-4 cards.

D-5 "Children's cards" are received by all children under 12 or 15 (the upper age limit is not clearly known) and also, apparently, by some or all students through the 10th grade of school.

Prior to October 1946 a large number of persons received special supplementary rations, most of which were, at least theoretically, designed to take the place of meals served in the institution in which the holder was employed. There were various categories of these supplementary rations: "Liter A," "Liter B," Dry Rations, "Abonnementy," Scientific Workers' cards, "R-4," etc. In addition, during the war, supplementary rations were issued to expectant and nursing mothers, blood donors, and hospital patients. The broad categories into which rationed food is divided indicate the inclusive and differentiated food rationing in the USSR.

Allowances for each ration category, often unfulfilled during the war, are shown in TABLE IX-22.

The special categories, which have been greatly reduced in number since October 1946, formerly allowed the holder a certain amount of bread, grits, sugar, fats, etc. So far as is known, all bread and all grits now have been eliminated. In the past, the meat ration has included fish or eggs when meat was scarce. The sugar ration has often been met with candy or cookies. At the present time, potatoes, other vegetables, and fruit are not rationed.

The rationed population obtains its food in so-called "open" and "closed" shops. "Open" shops, however, are not open to the general public but rather to the public of a given ration district. "Closed" shops are those connected with a particular place of work. They may also have an order department where special customers belonging, as a rule, to the more privileged official class leave their orders to be filled and call for them later, thus avoiding a long wait in line. These stores are usually much more adequately stocked than the "open" shops.

How well one is supplied with rationed food, therefore, depends upon whether one is able to trade in an "open" or "closed" shop. There are considerabel differences also among the latter, depending upon the particular organization or institution with which the shop is connected.

TABLE IX - 22

SOVIET BASIC RATION CATEGORIES, NOVEMBER 1946*

Food	Unit	Heavy worker R-1	Worker R-2	Employee S-3	Dependent I-4	Dependent IT-4***	Child D-5
Bread	Grams per day	650	550	450	250**	none	300†
Grits	Grams per month	2000	2000	1500	1000	1000††	1200
Meat and fish	Grams per month	2200	2200	1200	600	none	600
Fats	Grams per month	800	800	400	200	none	400
Sugar	Grams per month	900	900	500	400	400††	500
Salt	Grams per month	400	400	400	400	400	400
Tea	Grams per month	25	25	25	25	none	25
Matches	Boxes per month	3	3	3	3	3	3

* Only the few major changes indicated below took place in basic ration categories from September 1946 until early 1947. It is quite apparent that this ration classification is maintained only for purposes of keeping records straight.

** I-4 bread ration was reduced from 300 to 250 grams per day.

*** A new category IT-4 was created.

† D-5 bread ration was reduced from 400 grams to 300 grams per day. Children in the eighth, ninth, and tenth grades continue to receive 400 grams per day, as previously.

†† In December 1946 there was no sugar given on IT-4 cards, and in January grits were eliminated.

As a rule, the official Party (Communist Party), government, technical, and military personnel are best supplied. As for the general population, its rationed allotment of bread has usually been available, at least in the larger cities. Other rationed foods, however, are often not available in the "open" shops, or substitutes are offered. A large proportion of the rationed population has to supplement its rationed food allotment from other sources. Individual gardens have become an important source of supplementary food, largely potatoes.

Food, both on the rationed and unrationed lists, can also be obtained without submitting ration coupons on the private, or open market and in special government "commercial" stores, established in a number of cities in 1944. On the open market, at the bazaars to which peasants bring their surplus agricultural produce, consumers may purchase what foods are for sale. During the war, at least, much of this trade was on a barter basis, the city dwellers exchanging second-hand clothing and other consumer goods for foodstuffs. These bazaars are practically a legalized black market over which the state exercises police control. The so-called "speculation" or barter trading, which is not strictly legal, may be overlooked or the law may be strictly enforced, and consequently trading considerably curbed. Even more important is indirect regulation by the government of the private market through the competition of its own "commercial" stores, where food is sold without the requirement of ration coupons. These "commercial" stores also granted certain rather large groups of their customers 10 or 25% discounts, but in September 1946, these discounts were abolished. Since 1944 the government has also opened a few public restaurants where meals can be obtained ration free but at high prices.

In preparation for future derationing, the difference in price levels for food sold with and without ration coupons was markedly reduced by legislation in September and October 1946, lowering prices in "commercial" stores and raising prices in ration stores. Unrationed prices, however, are still very much higher than the fixed prices in rationed food stores and restaurants. TABLES IX-23 and IX-24 illustrate the effect of the changes on the monthly cost of rations for each category and on the individual food items in "commercial" stores.

Prices on the open market did not all drop when prices in "commercial" stores were reduced. The most marked exception was bread, which instead of dropping increased as much as 335% for black bread in Moscow. The reason for this is largely that the downward ration classification of many people, the discontinuance of special supplementary classifications (Litre A, etc.), and the creation

TABLE IX - 23

COST OF ONE MONTH'S RATIONS, IN RUBLES*, AUGUST AND NOVEMBER 1946

Type of ration	Cost in August	Cost in November
R1—Heavy Worker	99. 85	251. 53
R2—Worker	91. 30	255. 88
S3—Employee	59. 60	169. 43
I4—Dependent	36. 30	95. 45
IT-4—Dependent	.....	22. 30
D5—Child	49. 25	122. 03
Litre A	109. 55	244. 45
Litre B	96. 15	213. 45
Abonnement	58. 10	126. 03

* Official exchange rate of the ruble fixed at 18.9 cents United States currency; so-called "diplomatic" rate, 8⅓ cents.

TABLE IX - 24

COMMERCIAL STORE PRICES OF FOOD ITEMS, BEFORE AND AFTER 16 SEPTEMBER 1946, IN RUBLES PER KILOGRAM*

	Before 16 September		After 16 September
	Without discount	With 25% discount	
Beef	140	105	90
Smoked ham	470	352	220
Chicken	200	150	195
Sausage	300	225	140
Fresh fish	80	60	40
Cheese	270	220	170
Butter (salted)	400	300	240
Rice	70	52. 5	45
Wheat flour	35	26	24
Tea	380	285	380
Sugar (cube)	150	112. 5	70
Sugar (granulated)	120	90	60
Raisins (black)	240	180	70

* One kilogram equals 2.2046 pounds.

TABLE IX - 25

RISE IN COST OF FOOD FOR VARIOUS FAMILY UNITS— AUGUST–NOVEMBER 1946

Type of family unit and type of ration cards held	I Cost of rations, August	II Cost of rations, November	III Cost in November of same amount of food as purchased on rations in August*	IV Relation of cost in Column III to cost in Column I
	Rubles	*Rubles*	*Rubles*	*Percent*
Single man or woman:				
(a) 1 R-2	91. 30	256. 00	256. 00	280
(b) 1 S-3	59. 60	169. 43	169. 43	284
Husband and wife:				
(a) 2 R-2s	182. 60	511. 76	511. 76	280
(b) 1 R-2 & 1 S-3	150. 90	425. 31	425. 31	282
(c) 1 R-2 & 1 IT-4	127. 60	288. 18	750. 18	590
Husband, wife, one child:				
(a) 1 R-2; 1 I-4; 1 D-5	176. 85	473. 36	653. 36	370
(b) 1 R-2; 1 S-3; 1 D-5	200. 15	547. 34	667. 34	330
Husband, wife, two children:				
(a) 1 R-2; 1 I-4; 2 D-5	226. 10	595. 39	895. 39	397
(b) 1 R-2; 1 S-3; 2 D-5	249. 40	669. 37	909. 37	364
Husband, wife, two children, 2 elderly dependents:				
2 R-2; 2 D-5; 2 I-4	353. 70	946. 72	1306. 72	370

* It is assumed that difference between amount of food allotted on rations in November 1946 and in August 1946, is made up by purchasing on open market at prices prevailing there in November 1946.

of the IT-4 category meant that many people, who had formerly received more bread than they needed, no longer received such surpluses and did not trade with them on the open market. Furthermore, in Moscow "commercial" stores in the winter of 1946-47 bread became practically unavailable. The scarcity of bread on the open market and its high price encouraged speculators who bought in "commercial" stores for resale on the open market. To prevent this, bread has been sold in these stores only in combination with other foodstuffs.

As the result of official wage increases in September 1946, it is estimated roughly that 500 rubles per month, exclusive of tax deductions, etc., represented the average wage in the USSR. This average wage can be compared with the figures in TABLE IX-25 which shows the marked increase in the cost of food, the principal item of the Soviet worker's cost of living.

United States observers believe that these ration, wage, and price changes would force most families in the USSR to reduce their consumption of foodstuffs, would require persons who are employable but unemployed to seek work, would force the employed to work harder so as to increase their wages (in the USSR mostly piece-work rates are paid) or to seek additional work, and would compel those having liquid assets to liquidate these assets, including cash and surplus consumer goods, in order to purchase food.

D. Fisheries

(1) General

The most important fish-producing areas of European USSR, in the order of importance, are the Caspian Sea, the Black Sea, the Sea of Azov, and the Murman coast. Statistics published by Soviet authorities vary widely. TABLES IX-26 and IX-27, however, are fairly representative of published data on the catch, by species and areas. TABLE IX-28 gives planned catch, to be achieved by the end of the current Five-Year Plan (by 1950).

Fishing industries are collectivized in the Soviet Union and organized into large nationally planned trusts. Virtually all fishermen belong to cooperative farms, which the fishing industry is designed to assist. The cooperatives receive assistance from so-called "motor-fishing stations," which in fishing, play the same role as the machine-tractor stations play in agriculture. Most of the larger

TABLE IX - 27

TOTAL USSR CATCH OF MARINE MAMMALS, BY FISHING GROUNDS AND SPECIES, 1934

(Metric tons)

Species	Caspian	Black and Azov	Northern	Ob'	Far East	Total
Polar bear	.....	.....	.....	.....	.....	.....
Whale	.....	.....	.....	.....	9, 370	9, 370
Seal	3, 200	.....	4, 210	.....	.....	7, 410
Walrus	.....	.....	.....	.....	70	70
Sea-hare	.....	.....	.....	.....	.....	.....
Dolphin	.....	3, 390	.....	.....	.....	3, 390
Do. polar	.....	.....	110	100	340	550
Other mammals	.....	.....	20	.....	140	160
Total	3, 200	3, 390	4, 340	100	9, 920	20, 950

TABLE IX - 26

TOTAL USSR CATCH, BY SPECIES AND AREAS, 1934

(Metric tons)

Fishing grounds	Herring	Cisco	Large Chastik*	Small Chastik**	Cod	Salmon	Sturgeon	Flatfish	Carp	Other fish	Crabs	Total
Caspian	62, 900	204, 800	157, 800	47, 900	.....	1, 100	15, 100	....	....	5, 400	....	495, 000
Black and Azov	5, 300	11, 800	60, 900	48, 800	.....	.....	4, 500	700	....	130, 700	....	262, 700
Northern	114, 700	.....	14, 000	18, 800	93, 500	3, 800	....	2, 100	....	16, 200	....	263, 100
Ob'	.....	.....	4, 900	5, 600	.....	7, 000	1, 400	....	....	.....	....	18, 900
Far East	132, 200	.....	16, 300	8, 200	9, 200	128, 500	200	10, 800	....	5, 700	12, 600	323, 700
Aral	.....	3, 400	19, 700	3, 200	.....	.....	200	....	....	.....	....	26, 500
Balkhash	.....	.....	10, 000	3, 200	.....	.....	....	....	....	.....	....	13, 200
Unclassified	2, 700	1, 500	45, 100	63, 300	.....	400	2, 000	....	1, 600	6, 400	....	123, 000
Total	317, 800	221, 500	328, 700	199, 000	102, 700	140, 800	23, 400	13, 600	1, 600	164, 400	12, 600	1, 526, 100

* Miscellaneous large fish.
** Miscellaneous small fish.

TABLE IX - 28

TOTAL USSR PLANNED CATCH, BY AREAS, 1950
(According to fourth Five-Year Plan)

RSFSR	1, 884, 500
Ukrainian SSR	80, 000
White Russian SSR	5, 200
Uzbek SSR	22, 500
Kazakh SSR	97, 500
Georgian SSR	5, 500
Azerbaydzhan SSR	23, 900
Lithuanian SSR	15, 000
Moldavian SSR	1, 500
Latvian SSR	20, 000
Estonian SSR	20, 000
Karelo-Finnish SSR	15, 000
Total	2, 190, 600

fish-producing enterprises are under the People's Commissariat for the Fishing Industry. Secondary enterprises are under the People's Commissariats for local industry.

It is reported that 130,000 laborers and 220,000 fishermen were engaged in fishing in 1941. The only available figures on the number of fishing enterprises in the Soviet Union are given in TABLE IX-29.

TABLE IX - 29

NUMBER OF FISHING ENTERPRISES, USSR

Enterprise	1929		1933		1936
	Number	Capacity	Number	Capacity	Number
		Metric tons		*Metric tons*	
Cold storage plants	12	393 a day	21	828 a day	26
Ice producing plants	6	8,000 a yr	9	23,000 a yr	..
Canneries	4	.....	53	.....	55
Fish meal and oil plants.	1	.....	27	.....	28
Motor manufacturing plants.	..	.....	..	.....	1
Barrel plants	..	.....	..	.....	26

In 1935, Soviet fishing interests were reported to have 3,150 motor vessels with an aggregate of 230,000 horsepower. By the beginning of the Russo-German War this number had increased to 6,700. At that time there were about 100 trawlers.

During the 1930's it appears that Soviet fishing was largely dependent upon imports from the United States and Japan (the latter for the Far East region in particular) for the more advanced types of equipment, such as motorized fishing vessels, floating canneries and special types of nets. Some parts of machinery may also have been imported from Germany. Beginning roughly with the second Five-Year Plan, Soviet industry developed facilities for making more efficient and modern nets, machinery and vessels. From the outbreak of the Russo-German War considerable progress seems to have been made toward self-sufficiency in this respect. At the same time, official Soviet publications showed great interest in new developments in fishery technology abroad. Many of the articles published are descriptions of new machinery, taken from trade journals of American food and refrigeration industries.

Most of the vessels of the fishing fleet are small or average sized craft (presumably sailing vessels). Motored vessels are for the most part equipped with engines of 15 to 150 horsepower. In the past, ships were built in yards belonging to the fishing industry, mainly in accordance with local design and tradition. In recent years, however, ship-planning has been reorganized to keep pace with new developments in the fishing industry. Designs for new ships are now made by the Central Construction Bureau only. Standard types of ships have, in the main, been worked out for the fishing fleets of the Caspian, Azov - Black Seas and Aral Sea basins. It was planned to have standard types worked out for the North Basin by 1945. For the Caspian Sea, 32 types of craft have been proposed, including vessels for fishing, transport, and auxiliary service.

It appears that winches for trawlers, seiner's nets, lifting machines, capstans, and similar gear which had formerly been imported, were by the beginning of the Russo-German War supplied by Soviet plants. Production of metal floats was carried on in a factory at Odessa; mechanical lifts for purse seines could be manufactured in a Vladivostok dock yard. A four-inch centrifugal pump, similar to the Fairbanks-Morse pump, made in a factory at Moscow, is mentioned in a Soviet article.

Soviet fishermen adopted pound and purse seine nets to a large extent and Soviet workers learned to make them in the dozen years preceding the war. Before the war the Soviet net industry provided about two-thirds of the needs of the fishing industry of the USSR. Three important net-making plants were probably responsible for most of this production. These are the Reshetikhinskaya plant at Zhelnino near the city of Gor'kiy on the Volga, the Astrakhan' plant, and the plant at Kasimov in Ryazanskaya Oblast'. One other plant is the Kostroma plant, no doubt at Kostroma in Kostromskaya Oblast'.

The tabulation of dockyards of the fishing industry lists shipyards available to the fishing industry for building wooden boats and repairing metal ones.

DOCKYARDS OF THE FISHING INDUSTRY, USSR, FOR BUILDING WOODEN BOATS AND REPAIRING METAL ONES (Total 18)

Astrakhan' wharf in Kirova	Berdyanskaya dockyard
Astrakhan' metal works	Tobolskaya do.
Murmansk dockyard	Aral do.
Sosnovskaya do.	Bolkhash do.
Arkhangel'sk do.	Strunnoskaya do.
Soroskaya do.	Ship repair shop in Fridribha Engelsa
Azov do.	Diomid Sudoverf
Kerch' do.	Sakhalin Sudoverf
Kherson do.	Klynchevskaya Sudoverf

(2) Caspian Sea

The Caspian Sea is the most important fishing area of European USSR. The Caspian basin includes the whole sea plus the Volga (beginning from Saratov), the Ural, Emba, Kuma, Terek, Kura, and other rivers emptying into the Caspian. Each year 200,000 to 225,000 metric tons of fish are caught in the Caspian. Of this quantity, 65% to 70% are taken in March, April, and May; 9% to 10% in June, July, and August; 15% to 20% in September, October, and November; 4% to 5% in December, January, and February.

For the spring season 45,000 men are employed; for the autumn season 12,000 men. Of these numbers, 6,000 men in the spring and 2,000 men in the autumn are brought in from other areas especially for the fishing industry.

In the northern part of the Caspian Sea there is frost and ice in the winter. This is not true in the southern part. The northern third of the Sea, in a straight line from Cape Uch to Mys Tyub-Karagan, is much more important than the southern two-thirds of the sea as a source of fish. In the north are located the oldest, best-

equipped, and richest Astrakhan' fisheries, which operate chiefly in and off the mouth of the Volga. Conditions there are very favorable to fish. In the delta of the Volga are concentrated more than 200 large fishery establishments which account for about one-half the production of the whole Caspian basin.

While the southern end of the Caspian Sea reaches a depth of more than 800 meters, much of the northern end is less than 6 meters deep. This shallow northern end, which is fed by the tremendous inflow of water from the Volga, is an exceedingly rich fishing area. The annual catch here attains about 37 hundredweight per square kilometer.

The fishery operating from Astrakhan' is most productive in spring and fall, particularly in the spring. Between the left bank of the Volga and the Akhtuba the fall is the most important season.

In the southern part of the Caspian the best-equipped fishing industries are at the mouth of the Kura where sturgeon are caught, the better types in April.

The bulk of the catch in the Caspian consists of herring, pilchard, and cisco. Pilchard fishing was begun there in 1925 in the delta of the Volga and on the coast of Daghestan. In 1928 it was prohibited in the delta of the Volga, but in 1940 there was a very active fishing season for pilchard near the eastern shore of the middle Caspian. It is estimated that the potential catch of pilchard is at least 500,000 hundredweight annually. Pilchards are caught all year round, but mainly in the spring and on the western shore, incidental to herring fishing. Salting has been the only method of treating them.

Some seals are also taken in the Caspian, the total quantity in 1944 being 4,300. This, however, was an extraordinarily good year. These were taken near the river Zhili and sent to Artema island where they were manufactured into oil and lard.

(3) Sea of Azov

The Sea of Azov is connected with the Black Sea by the narrow Kerch Strait. Fishing in this region is concentrated in the delta of the Kuban' and Don rivers. Fish go through the narrow Kerch Strait early in spring and into the Azov for spawning. They remain until autumn, then return well fed and fat to the Black Sea. The Azov is very shallow, and owing to the many rivers that empty into it, is not very saline. Nevertheless it is remarkably rich in fish. The average catch is five tons of fish per square mile of sea surface. Some 115 species of fish live in the Sea of Azov and in the lower reaches of the rivers that flow into it. Among these are marine fishes of Mediterranean origin which migrate from the Black Sea only in the summer, permanent residents of the sea, and finally fresh-water species that inhabit the rivers and enter the sea only occasionally. Thirty-seven species are of commercial importance and include various sorts of sturgeon, herring, anchovy, pike-perch, carp, bream, and chub. The most valuable are those of the sturgeon family, the various herrings, carp, and bream.

Every autumn fishermen from the Don and Kuban' rivers, from the Crimea and the remotest shores of the Black and Azov Seas used to make the trip to the Tamanskiy Poluostrov, where they made big catches of anchovies. Before the war tinned fish was shipped to all parts of the USSR from Temryuk, the small port at the mouth of the Kuban' river.

Pound nets (that is, traps) are used in the Azov - Black Sea basin. Giant pound nets, adapted from Japanese designs, were first used in Kerch Strait in 1930. In 1944, the mouth of Kerch Strait was reported to be almost closed by nets. Mechanical net lifters are used to haul the net from the water to the fishing boats. Trailing nets are used in the main sections of the rivers Don and Kuban'.

It was reported in December 1944 that the Azov fisheries industry was building a cannery, with an annual productivity of 15 million cans, and also refrigerators and ship wharves. When the war began the first section of a large food combine had gone into operation at Nizhne-Dneprovsk. The plant was destroyed by the Germans, but the Russians report that much of the equipment has been repaired, and that the enterprise is already functioning.

In 1945 the Sea of Azov had some 100 collective fisheries and 14 motor-boat stations. The catch in some years has amounted to 150,000 metric tons. Practically the whole of the fishing industry on the shore of the Sea of Azov was ruined by the Germans when they occupied the coast. All the plants were looted and burned, the fishing fleet was scuttled, and equipment was removed. According to Soviet information reorganization has taken place rapidly.

(4) Black Sea

In the Black Sea, fishing is concentrated along the Crimean bank and in the Dnieper-Bug estuaries. Because of the proximity to market and convenient transportation facilities, two-thirds of the catch is marketed fresh. The bulk of the catch consists of beluga, sudak, leshch, carp, and taran. Scouting planes rove over the Black Sea and Sea of Azov searching for fish and radio the location to the fishing fleet.

(5) Northern seas

In the White Sea, the Barents Sea, and Kara Sea, there are very productive fishing grounds. In the Barents Sea the catch per trawler is between 3,000 and 3,500 metric tons per year. The most important ports are Murmansk and Arkhangel'sk. Information on the fisheries located in these areas is very scanty. Among the more valuable species in the Barents and White Sea are plaice *(Pleuronectes platessa)*, dab *(Pleuronectes limanda)*, long rough dab *(Hippoglossoides platessoides)*, halibut *(Hippoglossus vulgaris)*, cod *(Gadus morrhua)*, haddock *(Gadus aeglefinus)*, and catfish *(Anarrichas minor?)*. Among those taken in the Kara Sea are herring *(Clupea sp.)*, various species of sculpins, polar cod *(Boreogadus saida)*, eel pout *(Lycodes spp.)*, flounders of various species, salmon, smelt *(Osmerus eperlanus dentex)*, whitefish *(Coregonus sp.)*, sturgeon, char *(Salvelinus)*, stickleback *(Pygosteus pungitius)*, and burbot *(Lota lota)*.

The principal Murman fishing regions are the Murmansk and the Finmarken Banks and Nordkin and Bear (Medvezhiy) Islands. Hopen, an island south of Spitsbergen, is also well known for its abundance of fish.

The trawler fleet in the Barents Sea, returned to operations after war duties, has been supplemented with new units. The Murmansk shipbuilding yard of Markomrybprom expected to resume building new vessels in 1946.

The region of the Kara Sea from the shore to a depth of 20 meters is characterized by low salinity and high temperature and is an extremely good feeding ground for fish. The narrow strip of sea along the shore of Novaya Zemlya has fewer fish than the other coastal areas, probably owing to the fact that the water is more saline, is warmer, and the depth greater.

In the Gulf of Finland, salmon *(Salmo salar L)* are captured in Luzhskaya Guba, Narva Laht, and Koporskaya Guba as they approach the Luga and Narva rivers for spawning. The main catches are made in May and June.

In 1933, 335.8 centners (a centner is approximately 220 pounds) of salmon and sea trout *(Salmo trutta)* were obtained in Luzhskaya Guba, 48.7 centners in Kaporskaya Guba, and 6.4 centners in the Narva Laht.

In Luzhskaya Guba the great bulk of salmon migrate along the eastern shore; a few run along the western shore and the central part of the bay. In Narva Laht salmon proceed to the river Narva, passing near the northern and southern shores. In Koporskaya Guba the first individuals appear at the western shore.

During the winter, fishing is done under the ice of the White and Barents seas.

At Murmansk is located the Polar Institute of Fishing and Oceanography. It was reestablished after the war and was to resume weather forecasting for the trawler fleet.

Great multitudes of sea mammals abound in various parts of the northern seas. The drifting ice is thickly covered with seals in the winter. Airplane sealing is carried on in the White Sea with planes directing the ships. In 1936 the ice breaker *Georgia Sedov,* operating from Murmansk, opened the way for sealing ships which caught at least 2,000 animals. From the south, the ice breaker *North Wind* lead the steamer *Dezhnev,* with experienced seal hunters from Novaya Zemlya and maritime towns of Arkhangel'skaya Oblast', to a mass of seals. About Novaya Zemlya 20,000 to 80,000 are said to be taken annually by Russians; considerably more are taken there by the Norwegians.

Sharks and white grampus are hunted in the Zapolyarye. Fishermen operate from Poluostrov Kanin. An average shark weighs around 500 to 600 kilograms and a grampus two tons. These are taken for oil, meat, and skins. The shark meat is sent to the cannery at Shoina. Some of it is salted and sent to Arkhangel'sk.

(6) Fresh water

(a) Farm pond culture.—Fish are raised in artificial ponds in various parts of the USSR. In the Ukraine there are fish ponds aggregating in area 60,000 to 63,000 hectares. Before the war these produced approximately 14,000 metric tons of fish annually. Many of the ponds in the Ukraine were destroyed by the Germans in the war. Reconstruction is reported. In the region of Leningrad City, fish farms produced 60 metric tons of fish in 1943. There are fish farms in the Karelo-Finnish SSR.

(b) Rybinsk reservoir.—This reservoir produced in 1944 over 1,000 metric tons of pike, bream, and other fresh-water species. Pike-perch from the White Sea region and Amur carp are being introduced into this large inland sea. In 1944 there were two motor-fishing stations in the Rybinsk reservoir and it was planned to establish 11 more. It was also planned to place there 41 special motor boats of seagoing type. On the shore near Perebory Pier, at the mouth of the river Yug, a shipbuilding dock was under construction in June 1944. At that time, three factories were reported under construction for the manufacture of nets.

(c) Danube.—Before the war Russian fishermen took a thousand metric tons of fish a year from the Danube. Fishing in this region was resumed in 1945 and catches shipped to Moscow, Leningrad, Kiev, and cities in the Donets Basin. Fishing on the Danube continues all year, but the best catches are obtained in spring, fall, and winter.

(7) Leningrad District

The main fisheries of the Leningrad District, operating in Lake Pskov and Peipus Lake, in the Gulf of Finland, in Ozero Il'men' and Ladozhskaya Ozero (Ladoga Lake) supply respectively 47%, 27%, 13%, and 10% of the total production of commercial fish. Moreover, there are in this region 1,700 small lakes with a total area of 151, 718 hectares. The most important and valuable commercial species in the Leningrad region are: smelt, sprat, bream, sandre, gwyniad (one of the whitefishes), large vendace, and common vendace (whitefish).

(8) Lithuanian SSR

Lithuanian fisheries are small compared with those of other Baltic countries, and some fish always must be imported. Because of the short coast line and lack of good harbors, Klaipėda is the only good fishing port. The 1939 catch was 1,271 metric tons, with whiting the largest item.

(9) Estonian SSR

In Estonia there are 50 fishermen's associations. The most important fish taken are Baltic herring, lamprey, anchovy, and pike-perch. Five canneries have been reopened in Talinn.

(10) Latvian SSR

Latvia has 520 kilometers of coast line on the Baltic Sea and the Gulf of Riga, and 250,000 acres of lakes and ponds, as well as several hundred kilometers of rivers. From Latvia, fishing is carried on in the Gulf of Riga and off the shore of Kurzeme. Latvians caught close to 14,000 metric tons of fish in 1938. Almost half this quantity consisted of Baltic herring; next in importance were cod, flounders, and burbot. It is reported that the Germans destroyed a large part of the harbor installations and fishing fleet. In December 1944 it was reported that five canneries, as well as ship-repair facilities, were operating in Rīga. Salmon, lamprey, and smelt were being canned. A ship dock has been recently built at Mangali for building fishing vessels.

93. WATER RESOURCES

A. General

Natural sources of water supply, either of surface water or ground water, or both, are plentiful in all parts of European USSR except in the extreme south and southeast. In the west-central and northern parts, the climate is humid, precipitation is distributed fairly evenly through the year, and there is a close net of perennial streams. In the northwest, lakes are very numerous. To the south and southeast precipitation gradually decreases and the severity of summer droughts increases. Near the Black Sea, in the Crimea, and in the lower Volga River region all but a few streams go dry in summer and autumn. Three small areas bordering on the Caspian Sea and Black Sea are semideserts, where the only streams are dry washes that flow for brief periods after infrequent heavy rains, and even the few lakes and most of the ground water are saline.

Surface-water supply is complicated by the extensive freezing of rivers and lakes in winter. Over most of European USSR even the largest rivers are frozen for considerable periods each year. The periods of freezing are longest in the northeast, shortest in the southwest. The Dnestr, in the southwest, is ice bound on the average for 70 days; centrally located rivers, for 4 to 5½ months; and northern rivers, for 5½ to 7 months. Many of the smaller streams and shallow lakes, and even large rivers in the far north freeze to the bottom. Average seasonal dura-

tion of ice cover on streams and lakes is shown on FIGURE IX-53.

Water-bearing rock formations are widely distributed, although in many places they are only partly developed by wells. In large sections of the country, moderate to abundant supplies of good water can be obtained at depths ranging from 20 to a few hundred feet. In some areas, however, little or no ground water is obtainable.

All the larger cities obtain their supplies from nearby rivers or lakes and have modern purification plants and distribution systems. In some places, wells or springs are used as auxiliary sources. In the smaller towns, wells and springs are more commonly used for part or all of the municipal supply. Many small towns, however, have inadequate municipal water systems, and some have none. As a rule, people living in suburban districts outside the areas served by the distribution system use private wells. A tabulation of the sources and other features of the water supply systems of the principal cities is given in Chapter VIII, 81.

For village and farm supplies, wells, springs, and ponds are the most important sources; streams and lakes generally are used on a small scale. Surface water is important in some regions, however, where ground water is scanty or very deep.

Where other sources are deficient, small ponds created by earthen dams are used to store flood runoff. Although whole villages may depend on such a source, the water almost invariably is polluted. Wells are particularly numerous where aquifers are near the surface. The great majority of wells are dug rather than drilled. Most of them are less than 50 feet deep, have low yield, and are commonly badly polluted because of insanitary location and construction. Drilled wells are much less numerous, and are totally absent in large areas of the far north and east; they are most numerous in the more densely settled areas and in the semiarid south. Springs are preferred sources wherever they are available, as they are less liable to become polluted than wells or surface water; the majority, however, yield only a few gallons per minute.

B. Surface water

On the basis of abundance and regimen of surface-water sources, European USSR can be divided into six regions, or zones. Surface water is very abundant in the northwest, but decreases southeastward, the extreme southeast being semidesert (FIGURE IX-53).

(1) Lake region

The northwestern part of the country, adjacent to the Baltic Sea and Finland, is especially well supplied with dependable surface-water resources. Lakes of all sizes are very numerous and are connected by a close network of streams, nearly all of which are perennial and have much greater constancy of flow than those in other parts of the USSR. Water levels are highest in streams and lakes during the spring thaw, but few streams have severe floods, in contrast to the lake-poor humid region that adjoins on the east and south. The lakes act as regulators of stream flow by absorbing flood flows so that flood crests are greatly reduced, and gradually letting out the water so that flow is sustained over periods of low precipitation. In many parts of the region, lakes occupy 20% to more than 50% of the land area. Lakes are somewhat less numerous in an area near the Baltic Sea south of Lake Ladoga.

(2) Humid region

The region east and southeast of the lake region also has a humid climate and a close net of perennial streams. Lakes, however, are neither numerous nor large; most of them are mere ponds on the marshy lowlands of a few main rivers, and they have little regulating effect on stream flow. All the streams are in flood, commonly bank-full or overflowing, during the spring thaw, which occurs in late March or early April in the south, and as late as June in the extreme northeast. On several of the northern rivers, such as the Pechora, Mezen', and Kara, the spring floods are especially severe because of ice jams. The period of lowest stream flow is in late summer but only a few of the smallest streams go dry.

(3) Poles'ye (Pripet Marshes)

In west-central European USSR are extensive marshes, threaded with many sluggish streams and a few small lakes. Most of the region is flooded during the spring thaw in March. The water gradually drains away during the summer, and in late summer and fall many of the marshes become dry. Organic contamination from swamp vegetation and peaty deposits gives much of the water such a foul stench and taste that it is unfit for most uses. This contamination is worst during the low-water period in late summer.

(4) Transition zone

This region has a somewhat drier climate than the northern regions, and the summer dry season is more pronounced; the climate becomes drier from north to south within the zone. Most of the streams are perennial, but some of the smaller ones go dry during late summer and autumn. The proportion of perennial streams decreases southward; near the northern margin of the zone they are rarely more than 3 miles apart, but near the southern margin they are commonly 5 miles or more apart. Floods at the time of the spring thaw, in March or April, are somewhat less severe than in the humid northern regions, but commonly cause extensive inundation of the valley lowlands.

(5) Semiarid region

In the southernmost part of the country, the precipitation generally is less than 20 inches a year, and the rainfall is so scanty in summer and fall that the majority of streams go dry. Perennial streams are generally 5 to 10 miles apart near the northern margin of the zone, and decrease to as much as 20 miles apart near the southern margin. The high-water period is at the time of the spring thaw, in March or April, but floods are much less severe than in the northern regions, except on a few main rivers that head farther north. August and September are the months of most severe drought.

(6) Semideserts

Three relatively small areas in the extreme south are so dry that they are totally devoid of perennial streams. A few of the main drainage channels, heading in bordering highlands, flow during the spring months, but the rest of them flow only for brief periods after the infrequent heavy rains. The areas have a few permanent lakes, but all are saline. In parts of the lower Volga region, temporary ponds of fresh or brackish water collect in depressions after rains.

C. Ground water

Sources of ground water in European USSR may be divided into two main types: 1) the unconsolidated surficial sediments, which are the most easily accessible, and which in part contain the most productive aquifers; and 2) the bedrock formations (including poorly consolidated sediments of great thickness), less accessible than the surficial deposits, and extremely variable in yield and

chemical quality of ground water. The distribution of the water-bearing surficial sediments (non-water-bearing surficial sediments excluded) is shown on FIGURE IX-54; bedrock, both water-bearing and non-water-bearing, is shown in FIGURE IX-55.

Permafrost and salinity are two important factors influencing ground-water supply that are not entirely related to differences in rock types. In the far north, the ground is permanently frozen to great depth, thawing only at the surface in summer; in this region, much of which contains abundant ground water in thick sediments, special precautions must be taken in the construction and operation of wells. Areas of salty or brackish ground water, some quite extensive, are scattered over much of European USSR (FIGURE IX-7). Most of the salinity, especially in the north, is caused by salt deposits in the bedrock. In the southern arid regions, climate and proximity to the Black and Caspian Seas also contribute to the salinity of ground water. In the semidesert areas (FIGURE IX-53), the ground water typically contains 5,000 to 30,000 parts per million of chlorine; small amounts of fairly fresh water, however, can be obtained locally, especially in areas of dune sands, where at shallow depth a thin layer of fresher water floats on the salty water.

(1) Surficial sediments

The most accessible, and in places the most productive, aquifers are contained in the shallow deposits of unconsolidated sediments that partly or completely mantle the bedrock in most parts of the country. The principal source of ground water at shallow depth is the sandy or gravelly alluvium of the river lowlands (Map Unit 1, FIGURE IX-54). This is the most easily utilized of all the water-bearing deposits. Most of the rivers flow in wide, flat-bottomed valleys underlain by unconsolidated alluvium 10 to 100 feet thick, consisting of sand and gravel irregularly interstratified with silt and clay. In most places, these deposits contain good water-bearing sands or gravels within 50 feet, in places within 20 feet, of the surface. Locally, however, they are mainly clay, and the finding of good aquifers may require considerable exploratory test drilling.

Of the surficial deposits that mantle the bedrock outside the river lowlands, not all are water bearing. A large part, mostly silt and clay or, in the northern part of the country, boulder clay, yield little or no water. In places, however, these deposits contain water-bearing beds of clean sand or gravel; these water-bearing sediments are indicated as Map Unit 2 in FIGURE IX-54. Where these sandy or gravelly deposits are thin and deeply dissected by closely spaced stream valleys they yield little water, but where they are thick and only partly dissected by valleys they are important water bearers. Commonly the depth to water is somewhat greater than in the river alluvium.

(2) Bedrock

Large parts of European USSR are underlain by sedimentary bedrock formations that contain fair to good aquifers at depths between 100 and several hundred feet (Map Unit 2, FIGURE IX-55). In a few regions, however, the bedrock is mainly non-water-bearing or contains only salty water (Map Units 3 and 4), and the only source for ground water is in the overlying surficial deposits. In some other areas, the bedrock is so deeply buried beneath poorly consolidated sediments (Map Unit 1, FIGURE IX-55) that it is not important as a source of ground water.

The thick, poorly consolidated sediments that deeply bury the bedrock (Map Unit 1, FIGURE IX-55) are mostly favorable for the development of large ground-water supplies. Such deposits are commonly several hundred to several thousand feet thick, and are thus distinguished from the relatively thin surficial sediments that mantle most of the country. The thick sediments are mostly mixtures of clay and sand, containing irregularly distributed aquifers. Many of the deeper aquifers are artesian.

The sedimentary rocks (Map Units 2 and 3) mostly form great structural basins, with thick, nearly horizontal or very gently inclined strata of interbedded shales, limestones, and sandstones. The water-bearing beds are mostly limestone, and in places sandstone. Commonly they are interbedded with large thicknesses of shale, or dense sandstone or limestone, that yield little or no water. Many of the water-bearing beds are very extensive, some persisting for hundreds of miles. They outcrop in bands roughly parallel to the edges of the basins, and along their exposures water may be obtained from shallow wells. Where they dip beneath impervious strata they can be tapped by deep drilling. In some areas, however, the aquifers are so deeply buried beneath non-water-bearing beds (Map Unit 3) as to be beyond the reach of ordinary deep drilling. Much of the deep ground water is under artesian pressure and in places deep wells flow at the surface. However, the deep ground water commonly is strongly saline and extremely hard. Generally at depths below 2,000 feet the ground water is so mineralized as to be undrinkable. In some areas, nearly all ground water in bedrock is highly mineralized (FIGURE IX-7). This is true for areas where rocks of Permian age lie near the surface.

In the crystalline rocks (Map Unit 4), mainly granite, schist, and gneiss, ground water is present only in small amounts, in fissures and in the zone of weathered (rotten) rock. Only rarely can supplies for large towns be obtained from wells, and then only by drilling large numbers of wells.

Data on yields of wells in some of the representative ground-water areas of European USSR are given in FIGURE IX-8, and the areas are outlined. The percentage figures are only approximate, being based on insufficient data requiring much interpretation.

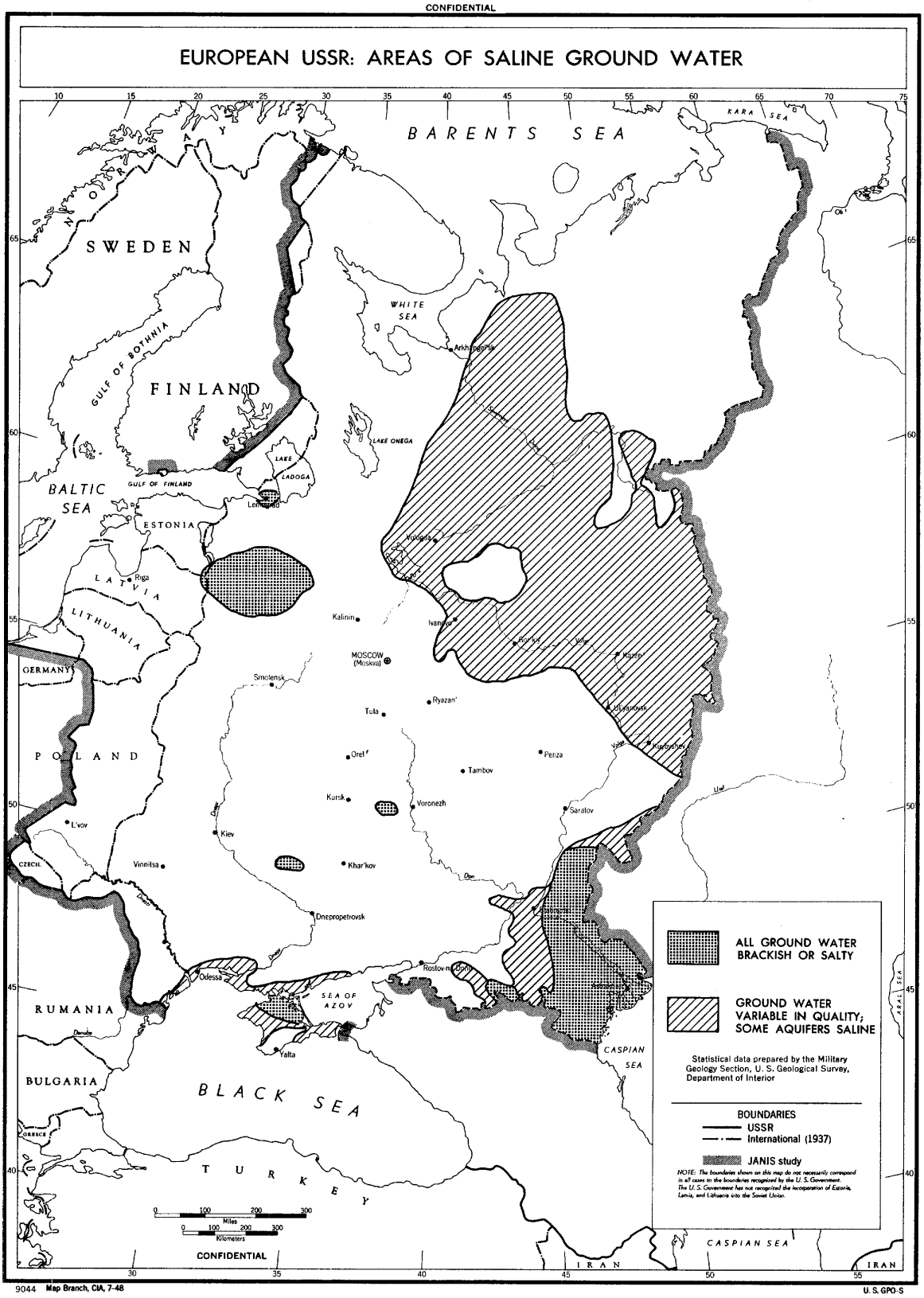
94. CONSTRUCTION MATERIALS

A. General

European USSR has an abundance of raw materials suitable for construction purposes. Timber, widely used both as construction material and fuel, is found in belts crossing the central and northern part of the region, although little or none is available on the steppes in the south, or on the tundra in the far north. Sand and gravel are widely distributed as surficial deposits. Building stone, crushed rock, and cement materials are available in almost every part of the area.

Before World War II, USSR (including both European and Asiatic) had been foremost in the world's timber resources. Up to 1940, USSR ranked among the first ten nations in world production of hydraulic cements. It is difficult to determine the percentage of these materials actually produced by European USSR as distinguished from Asiatic USSR. The accelerated building program of the five-year plans prior to World War II created a shortage in materials that was due not to lack of raw materials but to lack of equipment and facilities (such as transportation) for obtaining the materials. This situation is probably aggravated today by the great losses of equipment during the war.

FIGURE IX-7
SALINE GROUND WATER
JANIS 40
CONFIDENTIAL



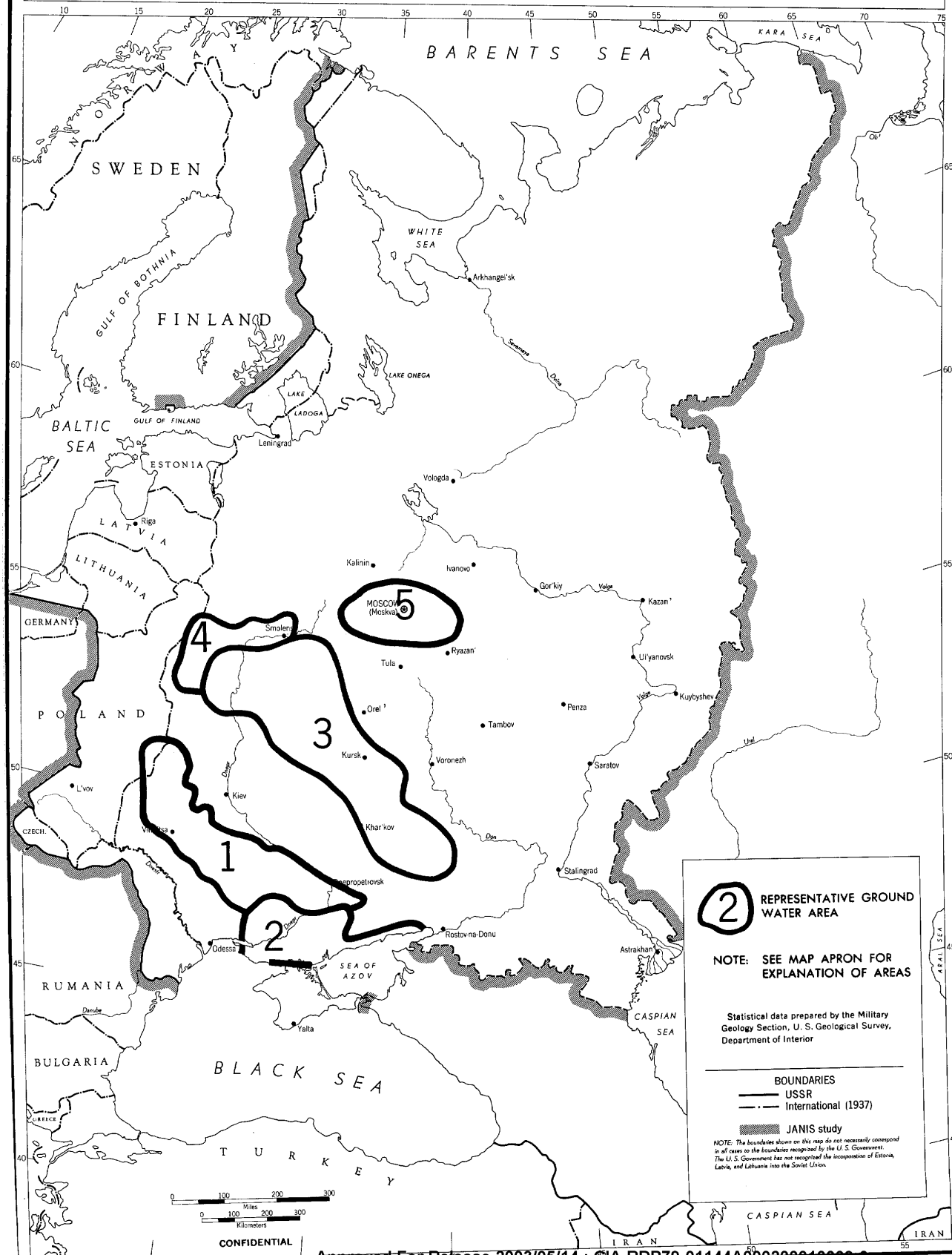
YIELDS FROM BEDROCK AQUIFERS IN SEVERAL REPRESENTATIVE GROUND-WATER AREAS

Area	Source Rocks	Percentage of wells with capacities of the following orders					
		5,000 g.p.m. (very high)	500 g.p.m. (high)	50 g.p.m. (medium high)	5 g.p.m (medium)	0.5 g.p.m. (low)	0.05 g.p.m. (practically dry)
1. Central Ukraine area	Granite, gneiss, schist, and allied rocks	..	..	14	45	29	12
2. Eastern Black Sea Coast	Tertiary sandstone and limestone aquifers	..	57	29	14	..	..
3. Southern Dnepr-Donets Basin	Cretaceous limestone aquifers	..	11	78	6	5	..
4. Northern Dnepr-Donets Basin	Devonian sandstone aquifers	..	18	73	9	..	..
5. Moscow Basin	Mainly Carboniferous limestone aquifers	1	21	61	16	1	..

FIGURE IX-8
WELL YIELDS
JANIS 40
CONFIDENTIAL

CONFIDENTIAL

EUROPEAN USSR: WELL YIELDS FROM BEDROCK AQUIFERS



CONFIDENTIAL

9045 Map Branch, CIA, 7-48

U. S. GPO-S

B. Timber

The USSR possesses the greatest resources of timber in the world, and a large part of the forests are in European USSR. The forests are of two distinct types: coniferous, and mixed coniferous and broadleaf, which cross the country in two broad zones from west to east into Asiatic USSR. Broad expanses of tundra in the extreme north and steppe in the south are almost barren of trees (FIGURE IX-56).

Within the coniferous forest zone, Scotch pine and spruce predominate. Fir, cedar, birch, and alder are well represented; larch is common in the east. Southward the coniferous forest grades into the zone of mixed coniferous and broadleaf forests which, in the central and western regions, consist of Scotch pine, spruce, larch, European fir, oak, lime, basswood, maple, ash, hornbeam, and beech. Farther south within this zone, forests are predominantly oak, and include maple, ash, basswood, elm, poplar, and some Scotch pine which locally forms stands on sandy soils near rivers. Scattered through the forests are many bogs and marshes.

In the far north are large expanses of tundra on which there are almost no trees, only thick mats of moss and lichen broken by bare patches of soil. In a few places, on the lee sides of hills and near streams, stunted and misshapen trees grow low and almost parallel to the ground. The steppes in the south are also almost barren of trees. The only trees found on these rolling, grassy plains are mainly poplars and willows that grow along the stream banks. The semidesert areas in the extreme south (FIGURE IX-53), which contain no perennial streams, are practically treeless.

Since 1917 large areas of virgin timber have been made available for lumbering; more than 9,000 miles of timber haulage roads have been constructed and more than 6,000 miles of river channels have been prepared for timber floating. Tractors are used on most of the roads to haul or drag the logs. The lack of labor in remote and thinly populated places has been overcome by a high degree of mechanization in felling and hauling the trees. Much of the tree felling is done during the winter. The logs are piled along the lakes and rivers to await spring floods for transportation to the sawmills. In the newly developed forests, sawmills and factories are set up near the cutting and the lumber is sawed and manufactured into standardized sectional houses and buildings, doors, window frames, and veneers. Chemical industries and the manufacture of paper are in many places associated with the sawmill and manufacturing combines.

The most important centers of the timber industry in European USSR are Arkhangel'sk (Archangel), Leningrad, Kirov, the coast of the White Sea, the northern and western shores of Ladozhskoye Ozero (Lake Ladoga), and the ports on the Gulf of Finland. Arkhangel'sk and Leningrad are the chief centers of the timber export trade.

About 50% of the pulpwood (for paper manufacture) and timber produced in the Soviet Union comes from the northern and northwestern parts of European USSR; the Leningrad region furnishes about 25% of all the pulpwood. About 20% of the timber exported by the whole USSR is produced in Karelo-Finnish SSR, where 60% of the population are engaged in the timber industry. In 1939, about 475 million cubic feet (13.5 million cubic meters) of timber were prepared for export in this republic; most of the lumber was shipped through Leningrad.

Lumbering is an important industry in all the Baltic republics.

In the region of the river Volga, sawmills are numerous. These supply lumber of the Moscow area, the steppe country, the Don River region, and even the cities along the shore of the Caspian Sea. About half the total production is used for construction; the remainder goes into paper, matches, and chemicals.

Total timber production in 1934, for the whole USSR, with the exception of Estonia, Latvia, Lithuania, and the newly acquired Polish territory, was as follows: sawed timber, about 883 million cubic feet (25 million cubic meters); plywood, about 17.4 million cubic feet (492,000 cubic meters). Deliveries of timber for industrial purposes totaled 3,519.4 million cubic feet (99.7 million cubic meters), for fuel 2,979.3 million cubic feet (84.4 million cubic meters). At the end of 1932, 2,800 sawmill frames were reported in operation.

C. Sand and gravel

Deposits of unconsolidated silt, sand, gravel, and boulders cover almost the entire surface of European USSR. Deposits of all types are not evenly distributed, however, as indicated by FIGURE IX-57 which shows the locations of sand, gravel, and boulder deposits that were operated prior to 1935. In the south and southeast, large quantities of sand are available from widespread deposits, but gravel is available in only a few scattered locations: near Odessa, in parts of the Crimea, and near Kuybyshev (Kuibyshev). In the west and central parts deposits of both sand and gravel are common and well distributed; in addition there are many deposits of boulders and cobbles. In the northeast, sand and gravel deposits probably are common but have not been developed. In the Karelo-Finnish SSR and in the Murmansk area in the northwest, sand and gravel deposits are sparse, thinly covering the bedrock. Very little information is available on the newly acquired territory on the western border of the USSR. However, it is probable that the distribution of sand, gravel, and boulders is similar to that in the adjoining regions to the east. In the Poles'ye (Pripet Marshes), sand is available from dunes mainly on the south side.

Almost all of this surficial material is suitable for fill. Most of the sand and gravel, especially that from terrace deposits, probably requires washing and screening before being used for concrete aggregate. The rock fragments are mostly fairly well rounded, and are hard and firm below the relatively shallow weathered zone. North of the permafrost line, excavation of sand and gravel is complicated by the permanently frozen condition of the ground at depth. The deeply weathered zones of the granite bedrock in southern European USSR are a source of angular rock fragments the size of fine gravel, excellent for use as road metal. This material is distributed over the same areas as the hard rock granite quarries whose locations are indicated on FIGURE IX-58.

D. Building stone

European USSR has a wide variety of materials suitable for building stone. The most common ones are limestone, dolomite, marble, sandstone, quartzite, granite, and traprock (FIGURE IX-58). Granite is present only in the northwestern and southern parts of the country. Limestone is widespread, but quarries are concentrated in the central part. Quarries indicated as limestone in the northwest are mainly marble. Many of the limestone quarries probably furnish rock for the manufacture of portland cement rather than for use as building stone.

Sandstone is most common in the south and southeast. In addition to these materials, numerous boulder deposits in central and northwestern USSR (FIGURE IX-57) have been the source of much stone used for paving and building.

Little is known about the building-stone industry. The parts of the country that produced the greatest amount of building stone in 1933 were the Moscow area 1,060,633 cubic meters, the Ukrainian SSR 2,908,288 cubic meters, and the Stalingrad area 888,594 cubic meters.

Overburden varies considerably in thickness and type of material, and affects the accessibility of the bedrock accordingly. In the Karelo-Finnish SSR, bedrock on hills is less than two feet beneath the surface and commonly is exposed over broad areas. South of this region the overburden is thick and consists of boulder clay and various types of alluvial deposits; to the south and east the overburden becomes thinner.

E. Cement

Limestone and clay suitable for cement manufacture are available throughout most of European USSR. The distribution of limestone quarries is shown in FIGURE IX-58. The USSR was one of the world's largest producers of hydraulic cement in 1940. Natural cement is found near Moscow and Saratov. In 1933, portland cement was manufactured near the cities of Leningrad, Moscow, Voronezh, and Saratov, and in the western regions, central Volga area, and the Ukrainian SSR.

F. Brick and tile

Clay used in the manufacture of brick and tile is available in abundance. The chief producing areas in 1933 were in the vicinities of Leningrad, Moscow, and Ivanovo, in the Ukrainian SSR, and in the White Russian SSR. Excellent refractory clay is found in the Baltic region, along the river Dnepr, and in the river Donets area.

G. Other construction materials

Other indigenous raw materials used in construction include alabaster, gypsum, tripoli, and chalk. Some asphalt is found along the river Samara in the Volga region. The shortage of materials before the war spurred the development of substitute building materials. These included artificial slate; roofing manufactured from peat mixed with cheap cement; *kamisheet,* made from reeds or mat grass; "artificial stone" slabs made of combinations of different materials such as wood dust, lime, and magnesite. These products were reported to be durable, waterproof, and less heat-conducting than brick.

95. MINERAL RESOURCES

Soviet statistics on all mineral reserves, including coal and oil, are grouped into several categories of reliability identified by the symbols A_1, A_2, B, C_1, and C_2. These categories may be defined as follows for minerals other than oil:

- A_1 — Broken or blocked-out ore.
- A_2 — Reserves fully studied and prospected; ready for development and extraction.
- B — Reserves fairly well prospected and delimited by excavations and borings; preliminary sampling done.
- C_1 — Reserves estimated from geologic studies of natural outcrops and, in a few places, from excavations; or estimated on geophysical data.
- C_2 — Reserves based on geologic appraisal of whole regions, districts, or basins.

In this report, except when considering oil reserves, the Soviet explanations for their lettered symbols are translated into terms now in use in the United States for estimates of reserves. Categories A_1 and A_2 are translated as "measured" reserves, B as "indicated" reserves, C_1 as "inferred" reserves, and C_2 as "geologically prospective" reserves. In the United States and most other countries "geologically prospective" reserves generally have not been computed or considered as "reserves", because of the high degree of uncertainty in such estimates. Therefore Soviet figures for "total reserves" which include the C_2 category, are usually not directly comparable with estimates for other countries. Most production and reserve figures in this topic have been derived from official USSR reports.

A. General

(1) Minerals

Iron and manganese are the most important of the metallic mineral resources of European USSR. Iron production steadily increased during the 1930's, and in 1941 exceeded 13 million tons,* which amounted to 60% of the USSR total. A large part of this came from a single district, the Krivoy Rog, in the Ukraine. Total reserves for European USSR are estimated at about 4.9 billion tons, or about 45% of the USSR total. Manganese is produced at the Nikopol' district in the Ukraine, which has accounted for nearly half of the total annual production of the USSR. Production of manganese ore in the middle 1930's exceeded one million tons per year; total reserves are estimated to exceed 400 million tons. Aluminum is third in importance among metal resources. Large reserves of low-grade ore occur in the Kola Peninsula and in the Leningrad area. Before the war, these deposits were the main sources of ore for the USSR aluminum industry which, early in the war, reached an annual production of about 300,000 tons of bauxite, roughly 5% of the world total. As a result of the war, however, the industry moved farther east, utilizing ores of higher grade in the Ural Mountains region and Asiatic USSR. Metals produced in minor amounts are: nickel, mercury, vanadium, lead, zinc, and magnesium. Deposits of copper and molybdenum minerals have been reported, but are not known to be of economic importance.

Among the nonmetals, phosphates are foremost in importance and are widely distributed; annual production approaches two million tons. Graphite production in the Ukraine reaches 17,000 tons of graphite rock annually, but constitutes only a minor part of the USSR total. Salt is produced in the Ukraine and in former Polish territory, and reserves are large. Potash also is produced in former Polish territory. Other nonmetals produced in minor amounts are fluorspar and sulfur. The production of mica ore in Karelo-Finnish SSR was only about 900 tons in 1939.

(2) Fuels

Coal resources in European USSR are extensive and of major importance. Coal production reached 96 million tons in 1940, mainly from the Donets Basin in the Ukraine, which supplied both bituminous and anthracite. The Moscow Basin is an important producer of lignite. Total coal reserves in 1937 were estimated at nearly 162 billion tons, or approximately 10% of the nation's total, which holds second place in world reserves. Reserves are largest and grade is highest in the Donets Basin; next highest is

* Throughout this topic, tonnages are expressed in metric tons: 2,204.6 lb. avd., unless otherwise specified.

the Pechora area of the extreme northeast, as yet but little developed.

Petroleum resources in European USSR are limited. Petroleum is produced in the middle Volga area, in the Ukraine, in the far north, and in former Polish territory. Production in 1940 excluding production in Polish territory, was about 1.8 million tons, or about 9% of the USSR total. Total reserves (exclusive of former Polish territory) are estimated at somewhat more than 200 million tons, or about 2.5% of the USSR total. Natural gas occurs in former Polish territory, in the lower and middle Volga areas, in the area bordering the Sea of Azov, and in the arctic. Production is small and the industry is comparatively undeveloped. Total reserves are estimated to exceed 246 billion cubic meters.*

Peat and firewood are widely used as fuels in central and northern USSR. Peat production was about 22 million tons in 1937, and reserves were estimated at nearly 46 billion tons. Peat is used both for heating and for the generation of electric power.

B. Minerals other than fuels

(1) Iron ore

(a) Production.—In 1941, production of iron ore in European USSR was reported to be 13,662,110 tons, with an iron content of 40 to 62 percent. This amounted to 60% of the total production of the USSR, and to about 14% of the total for the United States during the same year. During a part of 1941, however, important producing districts were under German control, with the result that production for that year declined sharply. Locations of major producing iron-ore districts, as well as smaller or undeveloped ore deposits, are shown on FIGURE IX-59.

In 1941, a single district, the Krivoy Rog, produced 11,841,690 tons of ore, or 52% of the total for the USSR, although it was under Soviet control for only seven months of that year. During the preceding year, the same district is said to have accounted for two-thirds of the total for the USSR.

(b) Reserves.—In 1939, measured and indicated reserves of iron ore in the principal ore districts of European USSR were estimated to be 2,692.2 million tons, or approximately 57% of the total for the USSR reserves in these categories. Inferred and geologically prospective reserves were estimated to be 2,204.4 million tons, making total reserves in all categories 4,896.6 million tons, or approximately 45% of the national total. A summary of reserves by districts is shown in TABLE IX-30. Additional reserves in deposits less favorable for exploitation, mainly in northern USSR, are reported in German sources to reach 1,850 million tons. Low-grade deposits, ferruginous quartzite, mainly at Krivoy Rog and Kursk, were estimated at 256,670 million tons in 1939, but no details are available.

TABLE IX - 30

ESTIMATED RESERVES OF PRINCIPAL IRON-ORE DISTRICTS, EUROPEAN USSR, 1939

Map number and name of district	Reserves			Range in iron (Fe) content	Proportion of total USSR reserves
	Measured	Indicated and inferred	Total		
	Millions of metric tons			*Percent*	*Percent*
1. Krivoy Rog	668. 4	822. 7	1, 491. 1	48–68	13. 8
2. Kerch'	1, 638. 2	1, 084. 2	2, 722. 4	30–40	25. 0
3-4. Tula-Lipetsk	210. 5	135. 9	346. 4	30–40	3. 2
5. Kursk	175. 1	161. 6	336. 7	30–57	3. 1
Total	2, 692. 2	2, 204. 4	4, 896. 6	.....	45. 1

(c) Principal districts

1. KRIVOY ROG.—This iron-ore district is located in the south-central Ukraine. The ore deposits are distributed along a narrow zone trending north-northeast for a distance of about 62 miles (100 kilometers). A northward extension of this district for a distance of some 68 miles (110 kilometers) is reported, but exploration is incomplete and information is meager.

The ore is of four main types: 1) martite, 2) magnetite, 3) red ironstone, and 4) brown iron ore; compositions of these ores are given in TABLE IX-31. The martite ores are the highest in grade, and constitute from 90% to 94% of the total ore reserves.

Ore bodies, mainly martite, occur in tightly folded and faulted meta-sedimentary rocks, and are of three main types: 1) large chimneylike or, less commonly, pocket-shaped deposits within the ore-bearing beds; 2) bedded deposits; and 3) small magnetite bodies of irregular shape. The chimneylike ore bodies range from about 330 to 1,600 feet (100 to 500 meters) along the strike, and from about 50 to 100 feet (15 to 30 meters) in thickness; horizontal area is maintained to depths of more than 1,000 feet (300 to 350 meters). Ore bodies of this type have been encountered in drill holes at depths of as much as 1,820 feet (560 meters).

The bedded deposits are about 3 to 40 feet (1 to 12 meters) thick, extend for distances of more than a mile,

* One cubic meter equals 35.314 cubic feet.

TABLE IX - 31

KRIVOY ROG IRON-ORE DISTRICT, EUROPEAN USSR, COMPOSITION OF ORES

	Martite ore (hematite pseudo-morphous after magnetite)	Magnetite ore	Red ironstone (hematite)	Brown iron ore (limonite)
Average iron (Fe) content	*Percent* 62. 95	*Percent* 57. 86	*Percent* 51. 50	*Percent* 57. 91
Range in chemical composition:				
Fe (iron)	60. 6 –64. 0	55. 3 –68. 5	48. 0 –55. 5	56. 4 –60. 6
SiO_2 (silicon dioxide)	5. 5 – 8. 8	2. 3 –13. 6	9. 9 –14. 5	5. 0 – 6. 7
Al_2O_3 (aluminum oxide)	0. 5 – 1. 0	0. 1 – 2. 6	2. 6 –12. 0	.....
CaO (calcium oxide)	0. 2 – 1. 2	0. 6 – 2. 9	0. 3 – 2. 9	.....
MgO (magnesium oxide)	0. 05– 0. 1	0. 04– 0. 7	0. 04– 0. 1	0. 18– 0. 5
Mn (manganese)	0. 06– 0. 2	0. 08– 0. 45	.....	.....
P (phosphorus)	0. 03– 0. 07	0. 03– 0. 05	.....	0. 06– 0. 09

and extend to depths of more than 1,300 feet (400 meters). The ore comprises both martite and hematite.

A fourth and minor type of ore body, limonitic in character, is formed by the weathering and erosion of older ores or ferruginous rocks; thickness generally is not greater than 100 feet (30 meters).

According to German sources, there were eight large mines and numerous smaller workings, with a total labor force of about 17,000 men in 1937. The largest mine in the district was opened in 1939. Mining operations are mainly underground, by sublevel stoping and sublevel caving methods.

Annual ore production has been as follows:

	Millions of Tons
1932	7.9
1933	9.0
1934	13.3
1936	17.5
1939	21.3
1941	11.8 (7 months)

The ore was smelted locally, with fuel from the nearby Donets coal area.

2. Kerch'.—These deposits are located on the Kerch Peninsula (Kerchenskiy Poluostrov) near Kerch Strait (Kerchenskiy Proliv) and the Sea of Azov (Azovskoye More). The ore is limonitic, and occurs in moderately folded sedimentary beds. Composition of the ore is as follows:

	Percent
Fe (iron)	33 - 40
Mn (manganese)	1 - 11
P (phosphorus)	0.7 - 0.8
S (sulfur)	0.04
As (arsenic)	minor amounts
V (vanadium)	minor amounts

The ore bed is 13 to 33 feet thick, and is mined by open-pit methods. The following production was reported:

	Tons
1933	282,100
1935	456,000
1940	800,000
1941	666,700

Reserves in 1938 were the largest in European USSR.

3. Tula and Lipetsk.—These districts are located in the central part of European USSR south of the Moscow area. The Tula district is about 115 miles south of Moscow, and the Lipetsk district is about the same distance south-southeast of the Tula district. The ore is of the brown or limonitic type, with 30% to 40% iron content; it undergoes concentration at the mine. Production in 1941 is reported to have been 438,750 tons for the Tula district, and 715,000 tons for the Lipetsk district, totaling 1,153,750 tons.

4. Kursk.—This district is located about midway between Moscow and the Sea of Azov. The ore minerals are martite and siderite. The deposits extend to depths of about 330 to 500 feet (100 to 150 meters). Iron (Fe) content of some of the ore is reported to range from 55% to 65%, but in other parts of the deposit the ore is of lower grade and requires concentration. A production of 900,000 tons of ore in 1938 is reported in German sources, but no other data on production are available.

(2) Ores of ferro-alloy metals

Locations of ore deposits of ferro-alloys—manganese, vanadium, nickel, and molybdenum—are shown on Figure IX-59.

(a) Manganese.—The Nikopol' district, one of the principal manganese producers of the USSR, is located in southern Ukraine on the west side of the Dnepr River, below the city of Zaporozh'ye. The ore bodies are flat-lying, bedded deposits averaging about 6.5 feet (2 meters) in thickness. In the western part of the district, one continuous deposit underlies an area of several square miles. In the eastern part of the district, there are five separate and smaller deposits.

The ore minerals, in order of their abundance, are: pyrolusite, psilomelane, wad, and polianite. Very minor amounts of limonite, manganite, and hematite are associated with the ore. Composition of the crude ore is as follows:

	Percent
Manganese	20 - 36
Silica	45 - 56
Iron oxide	4 - 6
Alumina	4 - 6
Phosphorous	0.2 - 0.8

An ore concentrate having an average manganese content of about 45% is obtained from the crude ore by milling.

Before the war, 21 mines were in operation. Mines are of the shaft type, and the longwall system of mining is used. Available data on production are as follows:

Year	Metric tons	Percent of total USSR production
1933	523,930	51.3
1934	861,100	47.3
1935	1,218,740	51.1
1936	1,299,870	43.3
1937	956,900	34.8

Total reserves are estimated at 401,400,000 tons, of which 310,300,000 tons are probably "geologically prospective (C_2)" category.

(b) Nickel.—Before annexation of the Pechenga (Petsamo) region the only nickel deposits in European USSR were located in the Kola Peninsula about 55 to 70 miles south-southwest of Murmansk. The ore minerals are sulfides. In one deposit, the nickel (Ni) content is from 0.2% to 0.5%, in the other it is reported to be about 4.8 percent. Total reserves are estimated at about 80,000 tons of nickel. A production of 500 tons of nickel is reported for 1938.

At Pechenga (Petsamo), there are tremendous reserves of nickel ore, sufficient to meet Soviet requirements.

(c) Vanadium.—Minor amounts of vanadium are associated with the iron ores of the Kerch Peninsula, and it is reported that at least part of the vanadium is recovered. No data on production are available. Vanadium ores also occur near Pudozh in southeastern Karelo-Finnish SSR. The ore contains 0.28% to 0.4% vanadium. The extent of development of these deposits is not known. In addition, vanadium ores are found in former Finnish territory near Pechenga (Petsamo).

(d) Molybdenum.—Molybdenum ores have been reported in the Kola Peninsula and in central Karelo-Finnish SSR, but no data on the character of the ore or on reserves are available. It is doubtful that these deposits are in production.

(3) Nonferrous metals

Locations of ore deposits of nonferrous metals—copper, aluminum, mercury, lead and zinc—are shown in Figure IX-59.

(a) Aluminum.—Aluminum production in USSR began in 1932, and steadily increased until, at the time of

World War II, the nation was virtually independent of imports. At the beginning, ore production was centered in European USSR, and the ores were of low grade. Later, large deposits of higher grade ore were discovered in the Ural Mountains, and production in that region became important. During the war, invasion or threatened invasion of the producing areas in European USSR led to dismantling the plants in those areas and shifting the industry to the Ural region.

The ores produced in European USSR were of two types: bauxite and nephelite. The bauxite was all produced in the vicinity of Tikhvin, and the nephelite in the Kola Peninsula. The fourth Five-Year Plan calls for increased production from the nephelite deposits.

The Tikhvin area is located about 125 miles east-southeast of Leningrad. More than a dozen individual deposits trend north-south in a strip about 50 to 60 miles (80 to 100 kilometers) long. The ore occurs in irregular horizontal lenses of different sizes. The ore is bauxitic laterite, with the following composition:

	PERCENT
Al_2O_3 (alumina)	45-53
SiO_2 (silica)	11-13
Fe_2O_3 (iron oxide)	14-20
CaO (calcium oxide)	1- 4

In 1931, three mines were reported; open-pit and underground methods of mining were used. At the beginning of the war, this area supplied about two-thirds of the total USSR bauxite; estimated production for 1938 was 160,000 tons. Total reserves were estimated as high as eight million tons in 1936, this amounted to approximately 13% of the estimated total for the USSR.

The nephelite deposits of the Kola Peninsula are located near the town of Kirovsk, about 90 miles (150 kilometers) south of Murmansk. The nephelite occurs in association with apatite, and is obtained as a byproduct of the recovery of that mineral. Nephelite constitutes from 20% to 25% of the apatite rock, and the pure nephelite contains 30% Al_2O_3 (alumina). It is reported that a plant for treating this ore was built in Karelo-Finnish SSR, but no data on production are available. Total reserves of nephelite are estimated at several hundred million tons.

(b) Mercury.—This metal is produced at only one place in European USSR. The deposit is located about nine miles south of Gorlovka in eastern Ukrainian SSR. The ore is a sandstone impregnated with cinnabar. According to German sources, the reserves were estimated at 16,500 tons of mercury in 1927, and the annual production since that time has been 300 tons per year.

(c) Lead and zinc.—Ores of these metals have been mined in the eastern Ukraine. At one time, the deposits were believed to be exhausted, but new veins were reported recently.

A zinc refinery located about 20 miles southwest of Stalino has treated ore from the far east. The refinery had a capacity of 16,200 tons per year.

(d) Copper.—Copper deposits in European USSR are of little importance. The deposits that have been reported are located mostly in the Karelo-Finnish SSR, and in the Kola Peninsula area. Meager information available indicates that the deposits are small and scattered, and that the copper content is low. Copper-bearing sandstone is reported southeast of Kazan' and in adjoining areas, but there is no indication that these deposits are of economic importance. There is also a small occurrence of copper south of the Kara Sea (Ostrov Vaygach).

(e) Magnesium.—Little is known concerning the production of magnesium in European USSR. The Ukraine is the main source of magnesium ore, and plants have been erected there for its treatment.

(4) Nonmetallic mineral resources

Locations of deposits of nonmetallic minerals are shown on FIGURE IX-60.

(a) Phosphates.—Phosphate rock is abundant in many parts of European USSR, and reserves are enormous. Total USSR production, mainly from European USSR, increased from 684,300 tons in 1932 to 1,792,700 tons in 1936.

Important apatite deposits occur in the Kola Peninsula of arctic USSR. They are located near Kirovsk, about 90 miles (150 kilometers) south of Murmansk. The ore is an apatite-nephelite rock, with a P_2O_5 (phosphate) content ranging from 16 to 27 percent. Production increased from 536,700 tons in 1932 to 2,920,000 tons in 1936, most if not all from one mine, the Kukisvumchorr. The deposit at this mine is an inclined, lens-shaped body about 1.4 miles (2.2 kilometers) long and about 500 to 650 feet (150 to 200 meters) thick. It is mined by open-cut method (benches in the mountain side). The apatite is recovered by flotation, with nephelite as a byproduct. Total reserves are estimated at 292,200,000 tons, for the Kukisvumchorr mine, and 561,000,000 tons for the entire district.

(b) Graphite.—Graphite production in European USSR is mostly in the southern Ukraine, and is reported to constitute a minor part of the total production of the USSR. The graphite is flaky-to-crystalline, and occurs in gneissic rocks. In one important producing deposit, near Mariupol', the carbon content of the rock is reported to be 6 to 7 percent. Total production from the Ukrainian SSR in the 1930's may have been as much as 17,000 tons of graphite rock. Estimates of total reserves range from one million to more than 11 million tons of graphite.

(c) Mica.—Mica deposits of commercial quality are located in the Kola Peninsula and Karelo-Finnish SSR. During 1939, 906 tons of mica ore was mined in the Karelo-Finnish SSR; during 1940, planned production was 1,300 tons. The crude ore is dressed and sized at a plant in Petrozavodsk which also treats mica ore from the Ural Mountains region.

(d) Fluorspar.—The only fluorspar deposits reported in European USSR are located in the far north, on the shore of the Kara Sea (Karskoye More), and west of Mariupol' in the Ukraine. German data report a production of 14,000 tons in 1934. No other data are available.

(e) Sulfur.—Sulfur deposits of minor importance occur in the Kerch Peninsula and along the middle course of the Volga. No data on production are available. Pyrite reclaimed from the beneficiation of coal is reported to be an important source of sulfur compounds, and in 1935 a production of 103,000 tons was reported; it is probable that this was largely from European USSR.

(f) Salt.—Rock salt is found in eastern Ukrainian SSR and in the southern part of former Polish territory. Reserves in the Ukraine are said to be large, but no data on production are available. Total reserves in former Polish territory have been estimated at two billion tons; production from this territory in 1929 was 55,664 tons.

(g) Potash.—Deposits of potassium salts are associated with rock salt in the southern part of former Polish territory. Total reserves in all categories have been estimated at 100 million tons of K_2O (potassium oxide).

C. Fuels

(1) Coal

(a) Production.—Coal production in the two major producing areas of European USSR, the Donets and Moscow basins, increased from 73,785,700 metric tons in 1935 to 96,500,000 tons in 1940. This 1940 tonnage was approximately 60% of the total production of the USSR. The Donets basin was the major producer, and supplied both bituminous and anthracite coal, including much of coking quality. The Moscow basin accounted for 8% to 11% of the joint production, and supplied lignite only. Minor producing areas included the Ukrainian lignite deposits, reported to have produced 400,000 tons in 1938, the Pechora basin of arctic USSR, reported to have produced 120,000 tons in 1937, and the middle Volga. Locations of principal coal areas and deposits are shown on FIGURE IX-61.

As a result of the German offensive, coal production in European USSR was greatly reduced, and sources in Asiatic USSR were utilized more fully. Following German retreat, production in the Moscow basin quickly returned to the prewar level, but rehabilitation of mines in the Donets basin was much slower, and by 1946 it was estimated that production was back to only about one-half the prewar level.

(b) Reserves.—Total reserves for European USSR are estimated at 161,854 million tons, approximately 10% of the USSR's total. Reserves are largest and quality is highest in the Donets basin. Next largest in size of reserves is the Pechora basin which is as yet comparatively undeveloped. Detailed data on reserves are given in TABLE IX-32.

(c) Principal areas and deposits

1. DONETS BASIN.—The Donets basin, the major producing area of the USSR, is located in the eastern part of the Ukrainian SSR. The total area of the coal field is approximately 9,000 square miles (23,000 square kilometers). The coal occurs in folded and faulted beds of lower Carboniferous to lower Permian age. In general, there are 30 to 40 workable coal seams, but locally the number increases to 65. Thickness of the seams generally ranges from about 1.6 to 2.3 feet (0.5 to 0.7 meters), and rarely exceeds 5 feet (1.5 meters). Some coal seams are traceable throughout the basin, but many split or pinch out. The coal ranks from bituminous to anthracite, with the volatile content ranging from less than 8% to more than 42 percent. In general, the volatile content of the coal decreases from north to south. It is estimated that 23% of the coal is suitable for coking, and it is reported that some of the anthracite is of a quality suitable for use in blast furnaces. Ash content is generally low (10% to 12%), and sulfur content ranges from 2.0 to 4.6 percent. Heating value ranges from 13,932 to 15,336 B.t.u./lb. A total of more than 300 workings include many large mines. The room-and-pillar method of mining is used. Annual production data are:

	Millions of Tons
1935	67.4
1936	75.2
1937	77.5
1938	80.7
1940	85.5
1941	63.5

Much of the coal is used in local metallurgical industries.

2. MOSCOW BASIN.—This area, south of the city of Moscow, is an elongate belt roughly 275 miles by 75 miles, extending east-southeast - west-northwest. Mining is centered in two parts of the area, known as the west limb of the Moscow basin, or Selijarovo district, and the south limb of the Moscow basin, or Tula district. The coal occurs in Carboniferous beds of very low dip. There are up to five workable coal seams, ranging in thickness from 6.5 to 16 feet (2 to 5 meters). The seams are discontinuous and irregular in form. Much of the coal lies at depths of less than 200 feet (60 meters). The coal is of the brown or lignitic type. Ash content is high, ranging from about 22 to 29 percent. Sulfur content is slightly more than three percent. There are about 55 mechanized mines in the area, with operations both at the surface and underground. Annual production data are:

	Millions of Tons
1935	6.4
1936	7.5
1937	7.5
1938	7.4
1940	11.0
1941	11.5
1943	14.3

The coal is used mainly for local power plants and industries. It is unsuited for metallurgical uses.

3. PECHORA AREA.—This area, in arctic USSR, contains large reserves of lignite and bituminous coal, but at present is mostly undeveloped. The coal is of upper

TABLE IX - 32

COAL RESERVES, EUROPEAN USSR, 1937

(Millions of metric tons)

Area	Reserves by Classes* of coal			Total reserves**	Measured, indicated, and inferred reserves	Distribution of reserves by depth		
	Anthracite Class A	Bituminous Classes B and C	Lignite Class D			To depth of 2,000 feet (600 meters)	Between 2,000 and 4,000 feet (600 and 1,200 meters)	Between 4,000 and 6,000 feet (1,200 and 1,800 meters)
Donets Basin as a whole (including Azov - Black Sea area and Ukraine).	33, 976	54, 896	.....	88, 872	24, 971	30, 000	33, 000	25, 872
Moscow Basin	.....	.....	12, 400	12, 400	1, 481	12, 400	.....	.....
Ukraine lignites	.....	.....	518	518	446	518	.....	.....
Pechora Basin***	.....	In part	In part	60, 000	.....	.....	.....	.....

* Class of coal defined according to COAL RESOURCES OF THE WORLD, XII International Geol. Cong., vol. 1, Canada, 1913.

** Includes thin coal seams, coals with high ash content, and "geologically prospective" reserves.

*** Estimates for this area were made later than 1937.

Paleozoic age, and occurs in folded and faulted beds. Data on the composition and occurrence of the coal seams are not available. Production was reported to be 120,000 tons in 1937.

(2) Peat

Peat is widely distributed and extensively used in the western and central parts of European USSR. In 1937, production was reported to be about 22 million tons annually, and total reserves were estimated at nearly 46 billion tons. Ash content is about 2.5 percent. Heating capacity is about 4,626 B.t.u./lb. (2,570 calories/kg.). Peat is used both for fuel and for the generation of electric power, and in some areas, it constitutes as much as 38% of total fuel consumed. Peat is of potential importance for producing gas for metallurgical and other uses.

(3) Firewood

In the forested areas of northern and central European USSR, firewood is an important source of fuel, and is used even in railroad locomotives. It is reported that in several regions every able-bodied citizen is required to produce approximately 8 cubic yards (6 cubic meters) of firewood per month.

(4) Petroleum

Soviet statistics on oil reserves are grouped into several categories of reliability identified by the symbols A_1, A_2, B, C_1 and C_2. These categories may be defined as follows:

A_1 — Reserves to be extracted by existing wells from producing horizons.

A_2 — Surveyed and delimited reserves, or reserves in a producing field ready to be tapped by additional wells efficiently spaced.

B — Reserves in horizons which contain oil as indicated by several existing wells, but not delimited or completely surveyed. Also, in producing fields, "B" reserves may be estimates for lower untapped horizons which are oil producers in adjacent fields.

C_1 — In producing areas this represents reserves in horizons the existence of which is not yet established but is assumed on the basis of the geological structure and location. In areas in which the presence of oil in economic quantities is not yet established "C_1" represents reserves assumed to be present in known and, in places, already partly surveyed favorable structures.

C_2 — Reserves in possible favorable structures, the presence and extent of which is assumed from the regional geology.

A_1, A_2 and that part of the B reserves which is estimated from existing wells correspond, in method of estimating, to the U.S. "proven" reserves. Reserves in the United States and some other countries generally are not estimated beyond the "proven" category. Obviously no direct comparison can be made between Soviet figures for "total reserves" (categories A_1 through C_2) and figures available for other countries. However, in the United States as soon as fields are discovered they are put in production and "proven reserves" can be calculated, whereas in the USSR geological prospecting is far in advance of exploitation. Therefore USSR "total reserves", even though including categories of low reliability, are significant in estimating their position in the world supply.

(a) Production and reserves.—European USSR contributes a minor part of the total USSR petroleum production. In 1940 approximately 1.8 million metric tons * were produced or roughly 9% of the total for the nation. Total reserves in 1937, as estimated by the Russians were over 200 million tons or about 2.5% of the USSR total. Of this figure only about 8 million tons are in categories A and B. Exploration is incomplete and it is probable that many fields remain to be discovered. The largest producing area, with the greatest reserves, is the Kuybyshev district. The western Ukraine is also a large producer but, as former Polish territory only recently incorporated in the USSR, it is not included in the production and reserve figures given above. Locations of principal oil-producing areas are shown on FIGURE IX-61.

(b) Principal oil-producing areas

1. MIDDLE VOLGA.—This area is located west of Kuybyshev (Kuibyshev) and surrounds a large bend in the river Volga. The oil occurs in sandstone of Carboniferous age, at depths of about 2,000 to 3,400 feet (640 to 1,040 meters). The oil has a gravity of 24.2° to 32.1° A.P.I., and a sulfur content up to 2.7 percent. Two oil fields (Syzran' and Saratov) rapidly increased production during the war. Annual production figures are:

	METRIC TONS
1936	110
1937	17,300
1938	65,700
1939	190,000
1945	1,375,000

Total reserves were estimated in 1937 at 187.5 million tons. Of this figure only 7.7 million tons were in categories A and B.

2. FORMER POLISH TERRITORY.—In the southern part of former Polish territory (now western Ukraine), a series of oil fields occurs in a northwest - southeast belt about 150 miles long, between Chernovtsy (Cernăuți) and Przemy'sl. Production in many of these fields began during the period from 1870 to 1890. The oil occurs in beds of Cretaceous, Eocene, and Oligocene age. Several hundred wells have been drilled, with depths ranging from about 650 to nearly 6,000 feet (200 to 1,700 meters) in the different fields. The crude oil in most fields is of paraffin-base type, with gravity ranging from 30.8° to 43.6° A.P.I. Annual production figures are available as follows:

	METRIC TONS
1936	403,000
1937	384,000
1938	370,000
1945	400,000 (includes Romny)

By far the largest producing field is near Borislav (Borysaw); in 1938 this field was reported to have produced 247,000 tons. Total reserves of the area are estimated at 150 million tons.

3. ROMNY.—This field is located near the town of Romny, in northern Ukrainian SSR. Production is reported to have begun in 1939. The oil is reported to come from beds of Carboniferous age at depths of about 1,300 to 1,600 feet (400 to 500 meters). It has a 1.05% sulfur content and a gravity of 16.8° A.P.I.

4. UKHTA.—This area is located in northeastern USSR near the town of Ukhta. Oil is produced from beds of Devonian age at shallow depths. The oil has a gravity of 28.2° to 50.1° A.P.I., and a sulfur content of 1.1 percent. Production in 1935 was about 26,700 tons. Total reserves were estimated at about 10 million tons.

5. OTHER AREAS.—Oil is reported to be present in the Pechora area, and about 80 miles northeast of Kuybyshev (Kuibyshev), but production is probably small and little information is available. The broad lowland along the Caspian Sea south of Stalingrad, is thought to be favorable for oil prospecting on the basis of the regional geology.

* One metric ton of crude petroleum equals approximately 7 barrels (42 gallons per barrel). All tonnage given is in metric tons.

(5) Natural gas

Utilization of natural gas has lagged behind that of other fuels in the USSR. Only in former Polish territory has production been large or continued. Other occurrences are located mainly in the lower and middle Volga areas, in the area bordering the Sea of Azov, and in the Pechora area of the north (FIGURE IX-61). Reserves in European USSR, exclusive of western and northern areas, have been estimated at about 246,490 million cubic meters*, approximately 25% of the total for USSR, and about three-fourths of this is in the lower and middle Volga area. Much of the gas occurs at depths of less than 700 feet.

In former Polish territory, production of natural gas, for representative years, is given below:

	MILLIONS OF CUBIC METERS
1916	352.0
1920	294.9
1924	372.5
1928	415.5
1932	350.6

Data on production for other areas are not available, but there is no reason to believe that the volume has been very large.

The gas field east of Saratov is of particular interest for its helium content, which averages 0.1 percent.

96. ELECTRIC POWER

A. General

The electric power capacity in European USSR at the end of 1946 totaled approximately 9.5 million kw., estimated to be over 70% of total Soviet installed capacity. The European USSR figure includes the operating capacity of 219 identified plants of 10,000 kw. and over, certain plants of strategic importance of less than 10,000 kw., and an unknown number of plants under 10,000 kw. having a combined installed capacity of 580,000 kw. (FIGURE IX-62). Approximately 40% of this power is concentrated in the central and northern parts of the Central Industrial region, mainly in the districts of Yaroslavl', Moscow (Moskva), Tula, and Gor'kiy. Four principal transmission systems have been developed and are supplied by about 66% of the total operating capacity of European USSR. Large power stations have been built, some with capacities up to 350,000 kw. The USSR plans by 1950, a 70% increase in power capacity, which when completed will total over 16 million kw. for the area. The current produced is almost entirely a.c., 50-cycle, and is distributed to consumers at 110, 220, and 380 volts. Three-phase current is supplied to industry and single-phase to commercial users and the limited domestic consumers.

(1) Power development and resources

In 1917, when the Soviets assumed authority in Russia, they gained control of a nation that had been committed to an agrarian economy. Some industrialization had already taken place and with it a corresponding growth of the electric power industry in the number and capacity of generating stations. At the beginning of the revolution, the total capacity of all stations in the USSR was estimated to be 1,100,000 kw. A large percentage of this equipment was damaged or destroyed during the war years. The plants were small and located only in major industrial centers and the chief cities. They had been controlled by foreign and private interests and were operated as separate uncoordinated systems without standardization of frequency or voltage. Fuels were obtained from distant sources; coal, for example, was shipped from England to fire the stations of St. Petersburg (Leningrad), and oil was hauled from the distant Baku fields.

With the end of the civil wars in 1921, an electrification program was drawn up by a specially constituted State Commission for the Electrification of the Soviet Union *(Goelro)*. The program was to be the basic blueprint for the reconstruction and further development of the country's electric power economy. It provided for the building of 30 regional electric power plants with a total capacity of 1,500,000 kw. within from 10 to 15 years. These stations were to be interconnected by high-tension networks and were to use cheap local fuels or water power.

At the outset the program lagged. Although the installed capacity totals rose, the high-tension networks remained in the planning stage. The use of peat, the principal local fuel available, on a large scale for power production, introduced new technical difficulties in combustion which were solved only after considerable experience.

Following the Goelro plan, successive Five-Year programs were inaugurated. From 1928 to the eve of World War II (1940), the total installed capacity of the USSR rose from 1.9 million to 10.5 million kw. (TABLE IX-33). Although the objectives of each Five-Year Plan were not fully realized, the USSR in 1940 was surpassed only by

TABLE IX - 33

DEVELOPMENT OF ELECTRIFICATION IN THE USSR

Year	Installed capacity (at end of year)	Production	Average plant factor	Increase in production over previous year
	1,000 kw.	*1,000,000 kw.-hr.*	*Percent*	*Percent*
1913	1,098	1,945	20.2*	....
1921	1,228	520	4.8*	....
1925	1,375	2,925	24.3*	....
1926	1,586	3,608	27.8	23.4
1927	1,698	4,205	29.2	16.5
1928	1,905	5,007	31.6	19.0
1929	2,296	6,224	33.7	24.3
1930	2,876	8,368	36.9	34.4
1931	3,972	10,687	35.6	27.7
1932	4,677	13,540	36.1	26.7
1933	5,583	16,360	36.4	20.8
1934	6,287	21,020	40.4	28.5
1935	6,880	25,900	44.9	23.2
1936	7,490	32,800	52.0	26.6
1937	8,120	36,400	53.2	11.0
1938	8,690	39,600	53.8	8.8
1939	9,520	43,530	54.5	9.9
1940	10,520	48,230	54.9	10.8
1941	8,220	50,200	55.0	4.1
1942	6,220	33,310	58.5	—33.6
1943	8,120	36,230	58.5	8.8
1944	9,700	44,710	57.3	23.4
1945	10,700	49,900	56.4	11.6
1946	12,500**	54,900	54.0	10.0
1947*	14,500	63,700	53.9	16.0
1948*	16,900	70,600	51.3	10.8
1949*	19,500	76,600	48.0	8.5
1950*	22,400	82,000	44.6	7.0

* Estimated.

** Over 70% (9,484,500 kw.) of this total was located in European USSR.

* One cubic meter equals 35.314 cubic feet.

the United States and Germany as a power-producing country.

At the end of 1946, the installed capacity for European USSR was approximately 9.5 million kw. and was produced by installations shown in the tabulation of types of plants.

Plant Type	Capacity kw.	Percent of total
Steam	7,713,942	81.3
Hydroelectric	1,098,640	11.6
Diesel	12,808	0.2
Unknown	659,110	6.9
Total	9,484,500	100.0

Some of the important power stations are listed in the tabulation showing plant number, name, type, and capacity.

Plant Number *	Name	Type	Capacity kw.
112	Dnepro-GES	Hydro	72,000 **
124	Zuyevka	Steam	350,000
194	Stalinogorsk	Steam	350,000
192	Shatura	Steam	225,000
191	Kashira	Steam	220,000
209	Go-GRES I	Steam	204,000
23	Dubrovka	Steam	200,000
108	Dneprodzerzhinsk	Steam	198,000
170	Shcherbakov	Hydro	165,000
119	Shter-GRES	Steam	152,000
176	Mo-GES III	Steam	150,000
160	Beketovka	Steam	150,000
180	Mo-GES I	Steam	125,000
204	Komsomol'sk Iv-GRES	Steam	124,000
212	Go-GRES II	Steam	124,000

* See Table IX-46 and Figure IX-62.

** Partly restored. Capacity when fully restored to be 585,000 kw.

Industry has been the chief consumer of the power output. Its share has remained relatively fixed at about 70% of the total production since 1928, and it is planned for a slightly greater proportion in 1950. Although Soviet authorities had made frequent references to a rural electrification program, the supply of power available to farm communities never rose above 1% of the national total (Table IX-34).

Notwithstanding the spectacular increase in the total generating capacity of the USSR, there is reason to believe that the expansion was accomplished at the expense of qualitative weaknesses and accompanied by high costs. Stations had not been built for automatic operation of basic functions as was the custom abroad, with the result that plants operated with an inflated personnel; large hydroelectric plants generated disappointingly low amounts of power; the transmission program had lagged; experimental stations for the testing of equipment did not exist; and the Soviet, in spite of the fact that a brand new power system was being conceived, was slow to adopt new and improved equipment.

The war was responsible for huge losses in power capacity. About 6 million of the 11 million kw. (total USSR, June 1940) were either destroyed or hurriedly evacuated to the east. The power stations wrecked by the invading armies included some of the largest in the USSR. The entire Ukraine, with a total capacity of 2,400,000 kw., was almost completely stripped of its power equipment (Tables IX-35 and IX-46).

TABLE IX - 35

LARGE POWER STATIONS OF THE EUROPEAN USSR DESTROYED OR EVACUATED DURING THE WAR

Plant number (Table IX-46)	Station	Type of plant*	Prewar capacity (1940)	Reconstruction progress
			kw.	
112	Dnepro-GES	H	558, 000	Partly restored (1947)
124	Zuyevka	S	350, 000	Completely restored
194	Stalinogorsk	S	350, 000	Completely restored
192	Shatura	S	225, 000	Partly restored (1944)
191	Kashira	S	220, 000	Completely restored
23	Dubrovka	S	200, 000	Completely restored
108	Dneprodzerzhinsk	S	198, 000	Unknown
119	Shter-GRES	S	152, 000	Partly restored (1946)
160	Beketovka	S	150, 000	Completely restored
126	Kurakhovka	S	100, 000	Partly restored (1946)
133	Krasny Sulin	S	100, 000	Unknown
24	Raukhialu	H	96, 000	Unknown
20	Svir' III	H	96, 000	Partly restored (1946)
134	Shakhty-Artem-GRES.	S	95, 000	Partly restored (1944)
188	"ZIS" Auto Plant.	S	75, 000	Partly restored (1944)
21	Volkhov	H	66, 000	Completely restored
115	Sevdon-GRES	S	65, 000	Partly restored (1946)
105	Khar'kov Plant II.	S	53, 000	Unknown
58	Kegums	H	51, 000	Partly restored (1946)
25	Enso	H	50, 000	Partly restored (1946)
111	Krivoy Rog	S	50, 000	Unknown
184	Frunze	S	50, 000	Completely restored
	Total 22 stations.		3, 350, 000	

* H—hydro, S—steam.

In spite of the widespread damage, the Soviet recovery was rapid. As the Germans retreated, stations were put back into operation by the advancing Russians. By the end of 1945 they were able to reach 10,700,000 kw. This amount included about 1 million kw. of equipment previously evacuated from the path of the Germans, and about 1,400,000 kw. received from the United States under

TABLE IX - 34

CONSUMPTION OF ELECTRICITY IN THE USSR

Users	1928	1932	1935	1937	1950*	1928	1932	1935	1937	1950*
	Billions of kw.-hr.					*Percent*				
Industry	3. 43	9. 30	17. 97	25. 28	58. 00	68. 5	68. 7	69. 4	69. 5	70. 7
Transport	0. 10	0. 26	0. 57	1. 02	2. 50	2. 0	1. 9	2. 2	2. 8	3. 0
Municipal	0. 96	2. 20	3. 76	4. 91	7. 50	19. 1	16. 2	14. 5	13. 5	9. 2
Rural	0. 04	0. 09	0. 19	0. 33	2. 80	0. 8	0. 7	0. 7	0. 9	3. 4
Transmission losses	0. 35	0. 96	1. 93	2. 62	5. 90	7. 0	7. 1	7. 5	7. 2	7. 2
Power stations	0. 13	0. 73	1. 48	2. 22	5. 30	2. 6	5. 4	5. 7	6. 1	6. 5
Total	5. 01	13. 54	25. 90	36. 38	82. 00	100. 0	100. 0	100. 0	100. 0	100. 0

* Estimated under fourth Five-Year Plan.

the lend-lease program which was probably installed before the end of 1945. The rest, about 3 million kw. was manufactured in the USSR. Even during the course of the war, the Russians maintained the construction of new stations. The large hydroelectric works at Shcherbakov (170) and Uglich (174) began operations while the war was in progress. TABLE IX-36 shows the estimated amount of power equipment received by the USSR according to its source.

TABLE IX - 36

ESTIMATE OF ACQUIRED POWER EQUIPMENT

(For the entire USSR—including 1945)

	Kilowatts
Seizures from Manchuria	1,000, 000 to 1, 400, 000
Seizures from Germany	900, 000 to 2, 730, 000
U.S.A. (Lend-lease equipment received but not installed by 1 January 1946 plus units destined for the Dnepr)	450, 000
Swedish trade agreement	400, 000 to 500, 000
Hungarian and Finnish reparations	290, 000
British deliveries	260, 000
Total	3, 300, 000 to 5, 630, 000

The progressive increase in generator capacity and power production of the electric power industry in the USSR is given in TABLE IX-33.

FIGURE IX-62 is the power map for European USSR. It shows the line of farthest penetration by the Germans and locates all known plants having capacities of 10,000 kw. or over and other strategic stations of lesser installed capacity.

(2) Projects planned and under construction

The electrification program under the fourth Five-Year Plan (1946-1950) provides for 11,700,000 kw. of new capacity for the entire USSR to be installed by 1950 to bring the national capacity to 22,400,000 kw. Planned power production will be raised to an estimated 82 billion kw.-hr. by the end of the program as compared to 48 billion kw.-hr. in 1940.

According to the program the total installed capacity of European USSR should reach 16,149,500 kw. by 1950. Of the 6,665,000 kw. which are to be installed, 6,034,000 kw. of new capacity are already under construction, 118,-000 kw. are in the planning stage, and 513,000 kw. are being added in the rebuilding of the Dnepro-GES (112). In addition to the latter figure, an undetermined amount of reconstruction work remains to be done in war-torn areas. This is expected to be completed in 1948.

Soviet leaders have repeatedly expressed themselves on the importance of hydroelectric development for the economy of the country. It is not surprising, therefore, to find so much of new construction in hydroelectric stations. The largest of the new stations now under construction are the Kuybyshev power dams—the Krasnaya Glinka (145) with an eventual capacity of 1,900,000 kw. and the Perevoloka (149) with a capacity of 1,500,000 kw. These stations, under way since 1937 may not be completed by 1950, but even partial operation of the installations will considerably affect the industrial capacity of the middle Volga area.

Other power plants of significance are the Kremenchug dam (101) on the Dnepr, which will not only make available 600,000 kw. of new capacity to the metallurgical industries of Krivoy Rog but will serve as a regulatory dam for the Dnepro-GES station (112), and the Kamyshin hydroelectric station (156) on the lower Volga which will provide 1,600,000 kw. for the Stalingrad industrial area. The Svir' II hydroelectric station (19), which is nearing completion or may already be in operation, is to serve Leningrad.

Two new steam plants, the "Semenov" (185) and the "Leningrad" (186) will add a total of 48,000 kw. to the Moscow capacity. A large thermal plant of 60,000 kw. capacity is scheduled for Kotlas (14), which would indicate a considerable degree of industrial or mining activity in that otherwise unpopulated area.

In addition to the power station construction, transmission lines are to be expanded and new lines built from Rogavka to Novgorod and from Uglich (174) to Kalyazin to Kashin.

The fitting of individual automatic electrical drives to machines is planned to be widely practiced, gradually to be superseded by machines in which the electrical drive is incorporated as an integral part of the design. The use of electrical processes is to be extended in the production of light and nonferrous metals, steel alloys and chemicals, and in metal treatment.

In addition to electrical developments in industry, more extensive use is to be made of electricity on the railways and in agriculture. Small hydroelectric, wind-driven, and motor-driven power stations using locomobiles (mobile power units) and gas-generator engines are to be built in large numbers in the rural areas. Work is to be continued on the extension of municipal heating in Moscow, Leningrad, Kiev, Khar'kov, and Rostov-na-Donu (Rostov-on-Don).

Extensive provision will be made for the adoption of the latest equipment and processes in the power stations—high pressure and high temperature steam, perfected turbines for heat generating systems, and the latest types of boilers, generators, and high tension apparatus.

(3) Current characteristics

Alternating current is predominantly used throughout European USSR. The utilization voltages supplied to consumers are 110, 220, and 380 volts. The standard frequency of 50 cycles has been adopted. Three-phase current is generally used for light and heavy industry, and manufacturing enterprises; single-phase current is used mostly for domestic requirements and small commercial users. There are a few small localities and isolated areas where d.c. installations are still in operation. The voltages generated by these small d.c. plants are 220 and 440 (TABLE IX-46).

The consumer's voltages for some of the large cities have been reported as follows: Dnepropetrovsk, d.c. 220 and 440 volts, a.c. 220 and 380 volts; Gor'kiy, a.c. 127 and 220 volts; Ivanovo, a.c. 127 and 220 volts; Kiev, d.c. 110 volts, a.c. 110 and 220 volts; Leningrad, a.c. 110 volts; Moscow, a.c. 110 volts; Odessa, a.c. 220 and 380 volts; Kuybyshev, a.c. 120 volts; Saratov, a.c. 220 and 380 volts; Stalingrad, a.c. 110 volts; and Yaroslavl', d.c. 250 and 500 volts, a.c. 230 volts.

The type of current distributed in the Baltic States is both a.c. and d.c. A.c. generating plants predominate, supplying three-phase, 50-cycle current. The d.c. installations have capacity ratings as high as 1,500 kw., but the percentage of their power supply is comparatively small.

Lithuanian SSR a.c. power stations supply three-phase, 50-cycle current at utilization voltages of 220 and 380. The d.c. installations, which are small capacity units, deliver voltages of 220 and 440 to consumers. The city of Kaunas is supplied by a.c. and d.c., and in the cities of

Klaipéda (Memel), Siauliai, and Vil'nyus, where the remaining power supply of the republic is concentrated, a.c. is generated as three-phase, 50-cycle current and distributed at voltages of 220 and 380.

The type of current reported in use within Latvian SSR is three-phase, 50-cycles; and the consumption voltages are 120, 220, and 380. The capital, Riga, consumes approximately 80% of the total power produced in the republic, and is supplied with three-phase, 50-cycle current at voltages of 120, 220, and 380. In Liepāja, three-phase, 50-cycle current is delivered at voltages of 220 and 380. Other towns and rural districts use three-phase, 50-cycles, 220 and 380 volts.

Estonian SSR generates approximately 85% of its power output as a.c., three phase, 50 cycles, and distributes at 220 and 380 volts for consumer use. All large cities have a.c. distribution. The d.c. voltage is supplied at 220, and the generating plants are located usually in small localities and isolated areas.

(4) Administration

In the USSR all plants are owned and operated by agencies of the Soviet government. For purposes of administration they are divided into three main groups: 1) regional plants supplying power networks or power pools for large communities and industrial areas; 2) municipal power plants and decentralized plants; and 3) independent power plants of industrial enterprises.

The highest Soviet authority for electric power is the Ministry of Electric Power Stations. Its function is to administer the regional plants, to plan for new construction, to establish the voltage and frequency standards, and to determine the rates to be charged to industrial and domestic consumers. Prior to the war over 70% of all electric power generated was produced by these plants.

Municipal and decentralized power plants are under the control of local authorities within the limits specified by the Ministry of Electric Power Stations.

Independent power plants are generally under the control and ownership of various agencies, factories, or combines to which they have been assigned. For example, the Zaporozhstal' works has its own power plant which is administered by the officials of the steel combine. Similarly, the Moscow-Volga canal (Kanal Imeni Moskvy) system and the Leningrad meat combine have their own power plants. Collective farms may purchase and operate their own power plants.

The Soviet Union is currently confronted with a shortage of skilled workers and technicians, due in part to the continuance of a prewar situation and in part to the necessity for rapid mobilization at the outbreak of the war. Since the end of the war, Soviet industry has not been able to satisfy requirements with demobilized soldiers and, with further large cuts in military manpower unlikely, much attention has been devoted to obtaining replacements and new trained workers.

The government has established numerous Labor Reserve Schools throughout the country to provide a manpower pool of 4.5 million skilled workers, technicians, and engineers. In 1946, these schools graduated 382,000 individuals.

Voluntary workers of various kinds have been used. German and Japanese prisoners have been assigned to the task of reconstruction of power stations. Dismantled plants from Germany have been shipped into the Soviet Union complete with their German crews.

The fourth Five-Year Plan announced the intention of providing for the training of skilled workers in all industries. Various regional institutes are offering courses for the training of highly qualified engineers to be assigned the task of rebuilding electric power stations. A widespread system of institutions for training skilled electrical workers existed before the war, and may be expected to be utilized to the utmost.

The success of these efforts to obtain trained workers will largely determine the government's ability to accomplish the objectives of the planned power plant program.

B. National and regional networks

(1) Pattern and significance (FIGURE IX-62)

The electric power industry of the USSR in 1940 had an installed capacity of approximately eleven million kw., including about 400,000 kw. gained by the annexation of territory in the west. It was rated the third largest in the world and was surpassed only by the United States (49,300,000 kw., 1943) and Germany (15,917,814 kw., 1937). In spite of heavy losses in generating equipment during the war, which amounted to approximately 50% of the total installed capacity, the power industry recovered very rapidly, and by 1945 the capacity had reached 10,700,000 kilowatts, a little short of the prewar level (TABLE IX-33).

The result of the evacuation of equipment during the war and the relocation of many industries in the eastern areas has been a shift of power capacity from west to east. This shift is expected to continue for some time, with the western and southern regions receiving a proportionately smaller share in the reconstruction of the electrical industry. Only the central industrial and Volga regions have been able to regain and surpass their prewar capacity, while the other regions will probably not do so until the latter part of 1948.

Transmission systems have been developed to serve industry and transport, the most important consumers. Little is known of the extent of electrification of towns, villages, and farms, but it is likely that electrification has not been extended to many localities outside the main transmission systems. In any case, industry has consistently taken approximately 70% of the generated power in the USSR since 1928, and only in the plan for 1950 is the rural economy to receive more than 1 percent. In 1950 this portion is to be 3.4 percent. The share allocated to municipal economy shows a steady drop from 19% in 1928 to a projected 9% in 1950 (FIGURES IX-9 to IX-12 and TABLE IX-34).

Large areas outside the regions of industrial concentration are still apparently without sufficient electrical power to furnish even a small percentage of the households or other small consumers. This situation will no doubt continue to exist for many years, in fact, until the USSR has achieved, first, an industrial development necessary for a high living standard and, second, an electric power industry which can produce a large surplus over the requirements of that industry.

Seven regions have been designated for the analysis of the power resources in European USSR which total approximately 9.5 million kw. These regions have been divided into geographical areas and their respective percentages of total installed capacity are as follows: Region I—North and Northwest, 19%; Region II—West, 5%; Region III—South, 21%; Region IV—Southeast, 3%; Region V—Volga, 12%; Region VI—Central Industrial, 38%, and Region VII—Urals, 2 percent.

(a) Region I—North and Northwest (TABLE IX-46).—This region includes the districts of Murmansk, Arkhan-

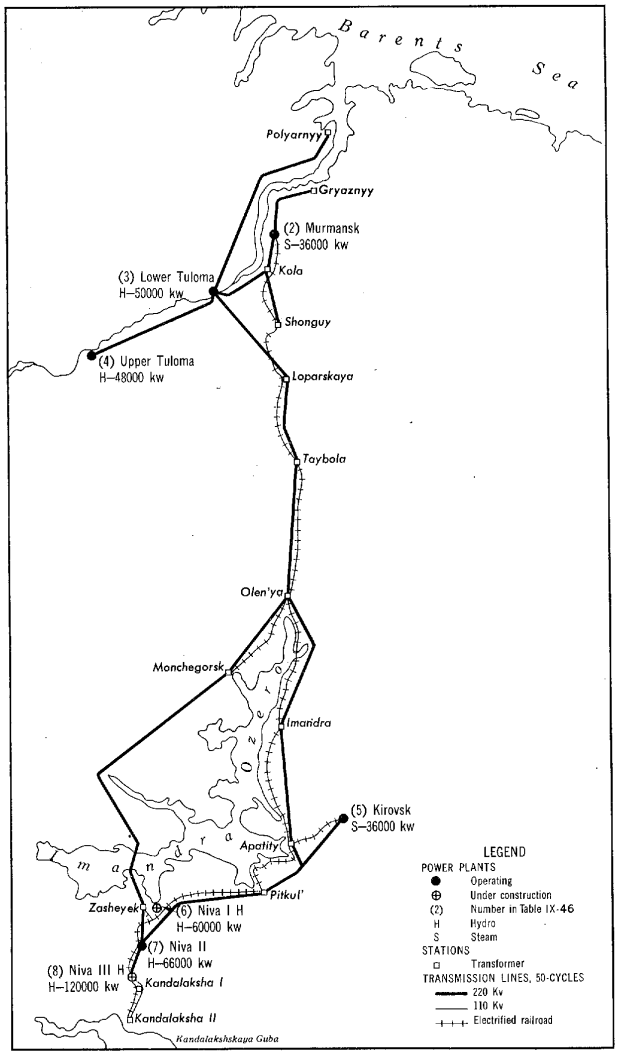


FIGURE IX-9. *Diagram of Murmansk transmission system, 1944.*

gel'sk, Vologda, and Leningrad, the Karelo-Finnish SSR, and the Komi ASSR. It contains 38 known plants of over 10,000 kw. and a few smaller ones, totaling approximately 1,809,000 kw. Of this total, 236,000 kw. are included in the Murmansk transmission system and 1,189,000 kw. in the Leningrad network. (FIGURES IX-9 and IX-10). The remaining 384,000 kw. are made up by power stations not connected to transmission systems but serving individual cities or industrial enterprises.

The power in the Murmansk-Kandalaksha district is used to operate the electrified railway between these two cities and to supply numerous mines and industries throughout the area. In the Leningrad district most of the generated power supplies the industry in and near the city of Leningrad. The power is produced by the hydroelectric plants on the Svir' (19, 20), Volkhov (21), and Vuoksi (24, 25) rivers; by the regional steam plants, Dubrovka (23), south of Petrokrepost' and Kirov (32) and Regional V (30) on the outskirts of Leningrad, and by twelve plants within the city itself.

The port cities of Murmansk and Arkhangel'sk are important due to their strategic location; Murmansk is an ice-free port. The Arkhangel'sk power station (13) has been reported as destroyed by bombing during World War II. The Janiskoski hydroelectric plant (1) located in the Pechenga (Petsamo) area, Finland, has been leased by the Russians to supply power to the nickel mines in the above area. The Kotlas area during the recent conflict assumed importance as a river port with its shipbuilding and repair facilities, armament manufactures, and other industries.

The remaining districts of Region I are sparsely populated and show little industrial development. Consequently, there are very few power installations of any size, and these supply local mining, lumber, and paper industries or furnish heat and light to municipalities.

(b) Region II—West.—This region occupies the western portion of European USSR. It includes: 1) the former Baltic States (Estonian SSR, Latvian SSR, and Lithuanian SSR); 2) a small area formerly belonging to East Prussia but presently known as Kaliningradskaya Oblast' and incorporated in the RSFSR; 3) White Russian SSR (Belorussiya).

The most important known power plants that were operating in this region have been listed in TABLE IX-46. The total installed capacity for this region is approximately 438,000 kw. The Baltic States under German operation reported 208,646 kw. of power, Kaliningradskaya Oblast' had 73,370 kw.; and White Russian SSR, approximately 156,000 kw.

TABLE IX - 37

POWER PLANTS IN THE BALTIC STATES, 1944

(Under German operation)

Type	Estonia			Latvia			Lithuania		
	Number of plants	Number of generators	Capacity	Number of plants	Number of generators	Capacity	Number of plants	Number of generators	Capacity
			kw.			*kw.*			*kw.*
Hydro	1	2	3, 520	8	13	52, 198	2	3	192
Coal	0	..	.....	4	13	59, 750*	1	3	8, 500
Peat	2	6	13, 750	0	..	.....	3	6	23, 155**
Oil-shale	2	6	26, 740	0	..	.....	0	..	.....
Diesel	1	4	252	3	4	10, 332	14	28	3, 950
Others	4	13	900	3	10	2, 702	16	39	2, 705
Total	10	31	45, 162	18	40	124, 982	36	79	38, 502

* Includes 5,000 kw. turbine installed at Liepāja and subsequently removed by the Germans.

** Includes 2,500 kw. turbine installed at Rekyvos' by the Germans.

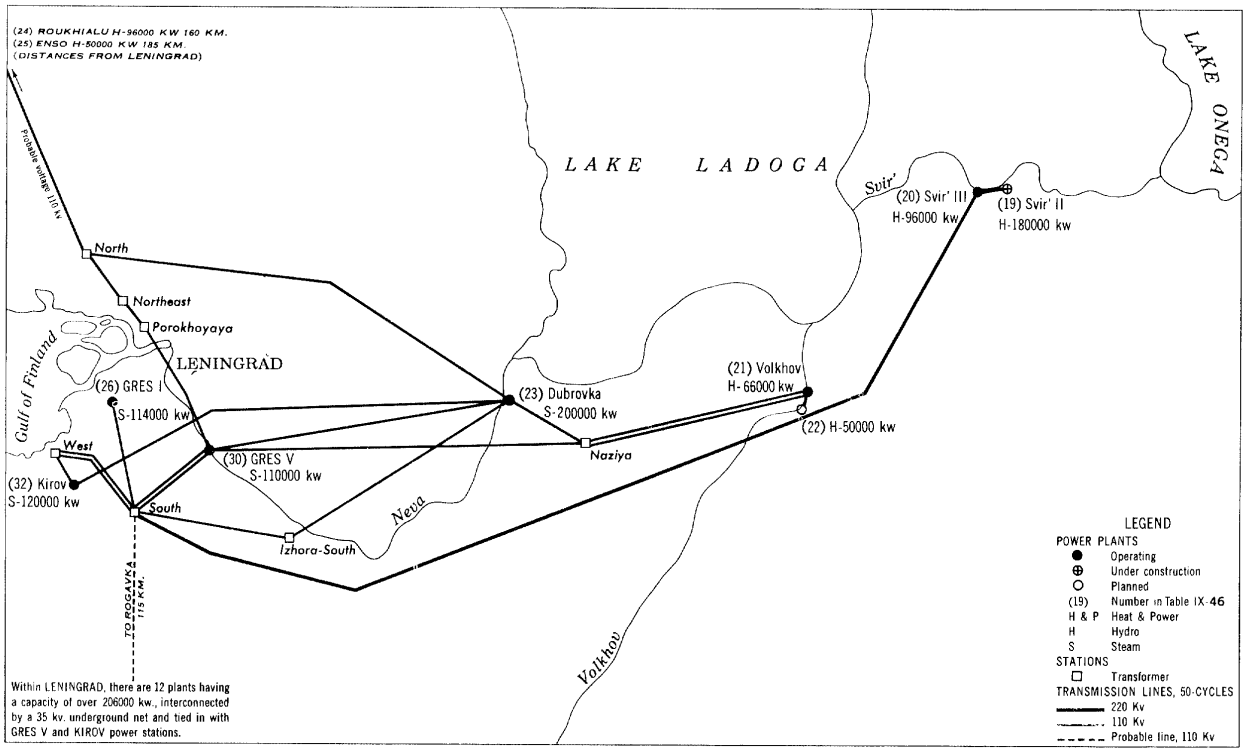


FIGURE IX-10. *Diagram of Leningrad transmission system, 1944.*
(Not to scale.)

1. THE BALTIC STATES.—Developments in the Baltic States in 1945 were for the most part concealed by the strict censorship imposed by the Soviet authorities. No foreign correspondents were admitted to those areas, and the scant information available from Soviet sources does not give a comprehensive picture of life in the reconstituted Baltic Soviet republics. As a result most of the news concerning the Baltic countries dealt with international status rather than with internal events and referred to them as a group rather than as individual states.

According to Soviet account the economic rehabilitation of these badly devastated countries made great progress in 1945. In particular, the Soviet press devoted a great deal of attention to the development of the Estonian shale industry, whose output not only provides liquid fuel for the factories, power stations, and homes of Estonian SSR, but is also used for the industrial city of Leningrad.

At the end of 1944 the only available statistics which could give a fair picture of the electric power industry were mostly for the period preceding the invasions except the reports prepared by the Germans during their occupation from 1941 until the fall of 1944.

The capacities and types of plants, under the German operation, are listed in TABLE IX-37, and the production of electric power according to consumption is shown in TABLE IX-38. The output in 1943 amounted to 440 million kw.-hr. and installed capacity totaled 208,646 kw. (1944) as compared to the 1936 figures of 121,154 kw. and 290 million kw.-hr. output of 343 plants known to be operating.

During the operation by the Germans most of the important transmission lines were put in operation, and a considerable number of transformer stations were newly constructed or reconstructed. New turbines and other

TABLE IX - 38

CONSUMPTION OF ELECTRIC POWER IN THE BALTIC STATES, 1943

(Under German operation)

Consumption	Estonia		Latvia		Lithuania		Total	
	kw.-hr.	*Percent*	*kw.-hr.*	*Percent*	*kw.-hr.*	*Percent*	*kw.-hr.*	*Percent*
Station operation and losses	18, 840, 218	18. 4	47, 976, 514	19. 2	24, 802, 785	28. 5	91, 619, 517	20. 8
Households	9, 406, 084	9. 2	63, 572, 436	25. 4	22, 885, 771	26. 3	95, 864, 291	21. 8
Industrial	12, 632, 025	12. 3	48, 174, 170	19. 3	26, 905, 662	30. 9	87, 711, 857	20. 0
Agriculture	226, 014	0. 2	3, 674, 634	1. 5	232, 795	0. 3	4, 139, 463	0. 9
Small users	15, 979, 211	15. 5	528, 864	0. 2	895, 248	1. 0	17, 403, 323	4. 0
Night current users	1, 869	....	31, 149	....	.....	....	33, 018	....
Wholesale consumers	671, 846	0. 6	.....	....	3, 193, 516	3. 6	3, 865, 362	0. 8
Street lighting	1, 884	....	12, 098	....	.....	....	13, 982	....
Associations	1, 353, 684	1. 3	.....	....	.....	....	1, 353, 684	0. 3
Special users	43, 654, 442	42. 5	77, 328, 285	31. 0	8, 100, 638	9. 4	137, 506, 860	31. 4
Streetcars			8, 423, 495	3. 4	.....	....		
Total	102, 767, 277	100. 0	249, 721, 645	100. 0	87, 016, 415	100. 0	439, 511, 357	100. 0

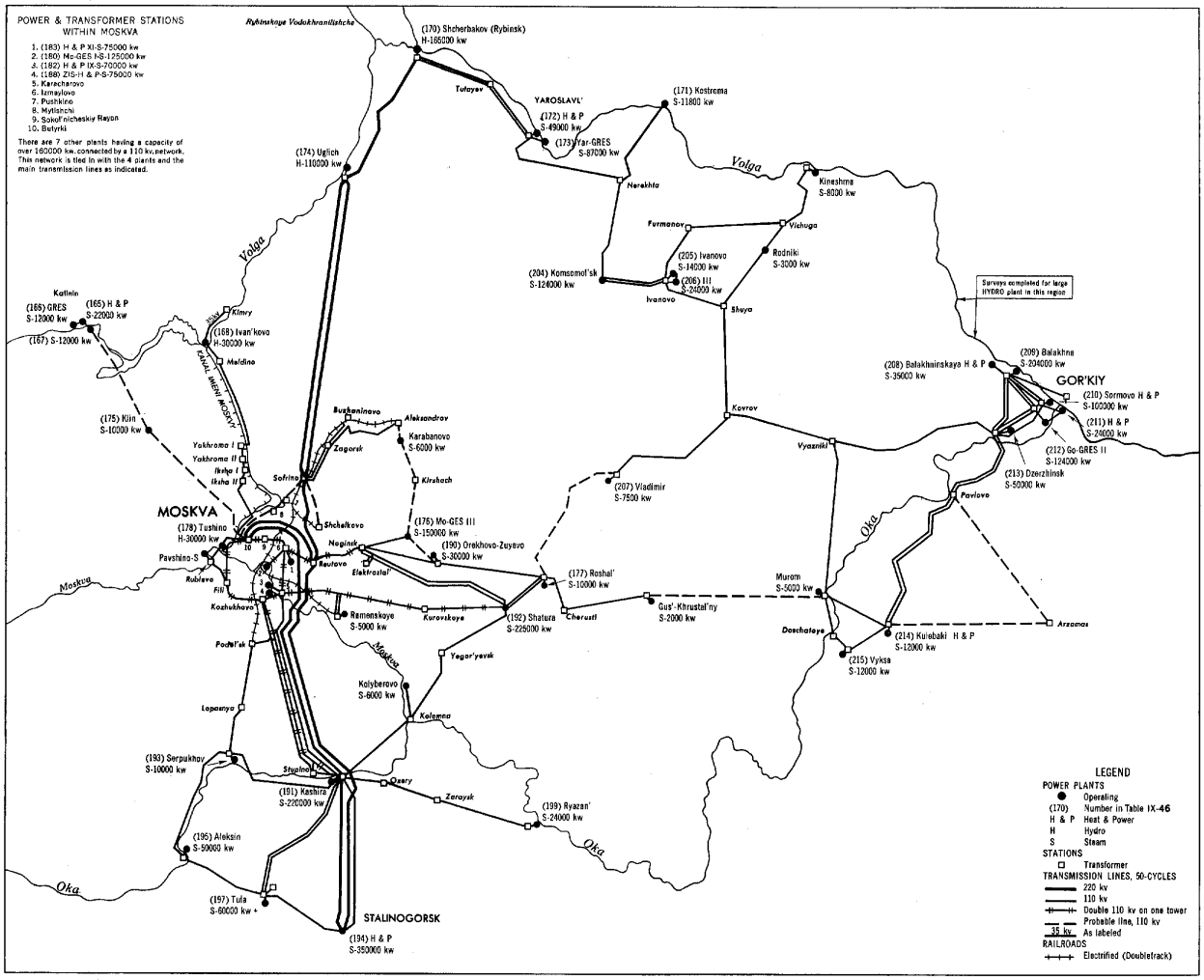


FIGURE IX-11. *Diagram of Moscow - Upper Volga transmission system, 1944.*

equipment were installed in the large plants and put in commission. Transmission lines placed in operation consisted of the following: 660 km. of medium tension; 4,500 km. of low tension; the 80-kv. 180-km. line between Jelgava and Liepāja in Latvian SSR; and the changing of the voltage from 20 to 80 kv. on the line operating between Ieriki and Valmiera in Latvian SSR. Extensive construction of 60-kv. lines was begun in Estonian SSR during 1943, and in Lithuanian SSR, a 30-kv. line connecting Šiauliai with Telšiai and Plungė was under construction. The plants in operation which received new turbines and other equipment are located in Tallinn (47), Ellamaa (53), Püssi (50), and Ulila (56) in Estonian SSR; Liepāja (60) in Latvian SSR; and Rėkyvos (64) in Lithuanian SSR. Improvements were made to the hydroelectric installation at Kegums (58) in Latvian SSR, and at Mariampolė in Lithuanian SSR a hydroelectric plant (250 kw.) was commissioned.

In the fall of 1944, when the Russian army advanced very rapidly in the Baltic States, the Germans were unable to evacuate much of the power plant equipment. In Lithuanian SSR some of the large transformers were evacuated from Kaunas (68) while in Joniskis and Šiauliai (62) the equipment remained intact. In Latvian SSR the 5,000-kw. turbogenerator together with its boiler equipment was evacuated from Liepāja (60), and from Rīga (57) some instruments, high tension material, and transformers were removed. From other points, several large transformers and about 60 smaller transformers (400 kv.a. capacity) were evacuated.

The largest and most important plant in Estonian SSR is located at Tallinn (47). Steam turbines are used for the generation of 50-cycle, 3-phase current, which totals approximately 20,000 kw. capacity, 5,000 kw. of which were installed during German occupation. Peat and oil shale are used as fuel. Most of the other plants of the country are of only local importance. Their power supply is divided as follows: oil-shale 40%, peat 25%, hydro 21%, and wood 14 percent. The water-power resources are estimated at 160,000 hp., 77,500 hp. of which are generated by the Narva (Kreenholm) falls (51, 52). Cotton mills and flax spinning and weaving mills located on the river Narva utilize part of this potential horsepower. In 1938, 30 turbines were operating and totaled 13,000 horsepower; their present status is unknown. Industrial and commercial consumption amounts to over 70% of the electrical output of the country. Eighty-five percent of the current supplied is a.c., using 3-phase, 50-cycle, 220 and 380 volts for power and single-phase, 220 volts for lighting. The remaining 15% is d.c., which is supplied at 220 volts. Edison screw-type sockets are generally used. Attachment plugs use only the pin-type caps.

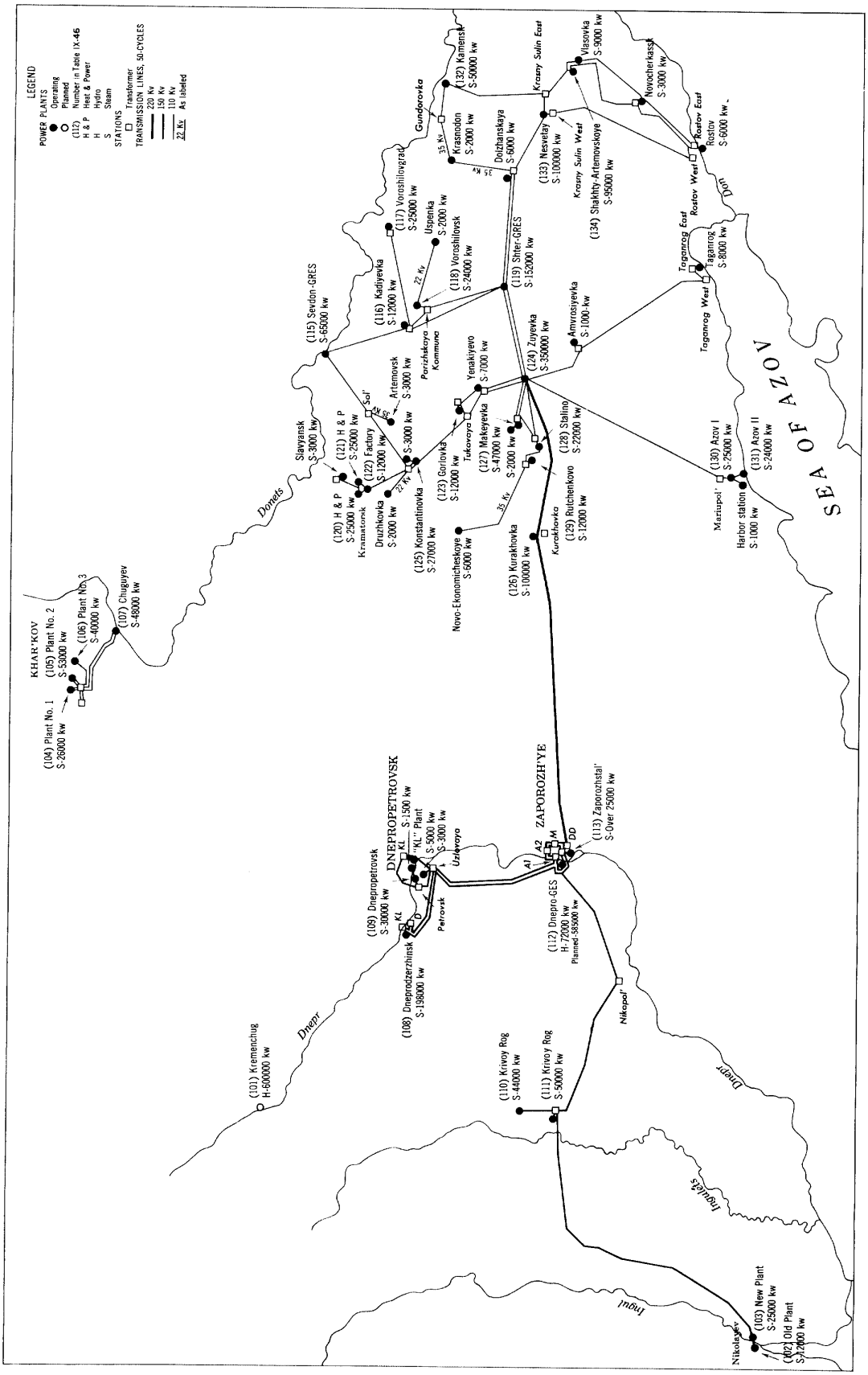


FIGURE IX-12. *Diagram of Dnepr-Donets transmission system, 1944.*

In Latvian SSR the most important and the largest industrial enterprises are located in Rīga, the capital. The prewar consumption of the city and its environs amounted to 80% of the total power consumed in the republic. This power is furnished by the Rīga municipal power station (57) which has a capacity of 20,000 kw., and the Kegums (58) hydroelectric station which is connected to the city network through a transformer station (88,000/20,000 volts) and supplies 51,000 kw. The current used in Rīga is 3-phase, 50-cycles; 110 volts single-phase being used for lighting, and 3-phase, 220 and 380 volts for power. According to Soviet reports, the city is presently manufacturing hydroelectric turbines (40 to 300-kw. capacity) for use in mills and peat plants.

Liepāja (60) is the only other important city in Latvian SSR. The present installation has been reported as 13,000 kw. During the war this capacity reached 18,000 kw., but in 1944 the Germans evacuated a 5,000-kw. turbogenerator unit.

The prewar transmission network (1933) of Latvian SSR amounted to 2,669 km. of low tension and 1,577 km. of high voltage. Within Rīga an extensive distribution network had been developed. Most of the rural districts and towns which are supplied with power use 3-phase, 50-cycle current, and utilization voltages of 220 and 380.

The power supply of Lithuanian SSR is concentrated mainly in the four cities of Kaunas (68, 69), Šiauliai (62), Klaipėda (61), and Vil'nyus (70). Kaunas has two plants totaling 11,598 kw., with additional construction reported in 1946 at the Petrašūnai (68) plant. In Šiauliai there are two plants; in Vil'nyus, one of 4,800-kw. capacity, and two smaller ones of unknown capacity were reported operating within the city. Klaipėda (Memel) was one of the principal consuming cities prior to the war. It is the only seaport of Lithuanian SSR. Recent reports (July 1946) state that a large power plant was under construction. The present operating capacity of the steam turbine plant is 4,500 kw.

2. KALININGRADSKAYA OBLAST'.—This region which formerly belonged to East Prussia but is presently incorporated in the RSFSR, has a known installed capacity of 73,370 kw. Two of the three steam plants are located at Kaliningrad (72, 73) and the other at Gusev (74). The hydroelectric installations are at Pravdinsk (76) (FIGURE IX-23) and Gross Vonsdorf (75). Additional information regarding other plants in operation is not available.

3. WHITE RUSSIAN SSR.—The entire region of White Russian SSR was captured by the Germans in 1941. It was recaptured by the Russians during the fall of 1944. Little information is known about the power installations as of the end of the war, but it may be assumed that there was some damage. The approximate capacity of the whole region is 156,000 kw.

Consumption of electric power has not been large. The region has been backward as far as industry and mining enterprises are concerned. The most important and largest power plant is the "Bel-GRES" (85) located north of Orsha. The station began operating in June 1946, with a reported capacity of over 20,000 kw., and provides power for the city of Orsha and the peat production of the region. The type of fuel used is peat, as the peat bogs within this area offer an adequate source of supply. High-voltage transmission lines lead from the plant to Orsha, Mogilëv, Vitebsk, Baran, Kopys', Shklov, and Dubrovno.

There are small power plants located in the western part of the republic at Brest (80), Nesvizh (81), and Molodechno (77). Other smaller plants are at Minsk (83), Bobruysk (84), and Gomel' (89). An extensive program has been outlined for the building, by the end of 1946, of 30 small rural power plants, 63 transformer substations, and 300 km. of transmission lines, and for the supplying of 140 collective farms throughout the republic with electric power. Information is not available on the progress of plans for building a plant to repair the equipment of the rural power plants.

(c) Region III—South (TABLE IX-46).—Electric power production is well developed in this part of the country and supplies the needs of the important industrial and mining area of the Donets Basin. The extensive network in the Donets Basin itself is supplied by some 35 steam-powered stations, six of them of large size, and one, the Zuyevka plant (124) at Khartsyzsk, the largest steam plant in the USSR. This system is joined by long distance transmission lines to the Dnepr river system, which includes the huge Dnepro-GES (112) and the steam plants at Dnepropetrovsk (109) and Dneprodzerzhinsk (108) (FIGURE IX-12).

The estimated total capacity of Region III is 1,991,000 kw. The greater part of this total, 1,483,500 kw., is included in the Dnepr-Donets transmission system, which also extends into Region IV, and another 167,000 kw. in the small transmission network in the Khar'kov area.

The remainder of the total, 340,500 kw., is made up by power plants in Kiev (158,000 kw.), Poltava, Aleksandriya, Kirovograd, Odessa, Kherson, Sevastopol', and Kerch'. The other plants range in size from the 80,000-kw. heat and power plant in Kiev (96) to several of only a few hundred kw., and are of only local importance.

There are several important points to be observed in connection with the electric power production of Region III. First, the aggregation of power in the Donets Basin is apparently sufficient to support a high concentration of heavy industry; second, the high tension line to Zaporozh'ye enables the Dnepro-GES hydroelectric station to furnish a large part of the load during high water periods, while the large steam plants are overhauled or used as standby reserves; third, the large hydroelectric project at Kremenchug, of 600,000-kw. capacity, will not only add greatly to the available power, but will regulate the flow of the Dnepr, greatly increasing the annual production of the Dnepro-GES.

Outside the power network are large areas which apparently have no large power plants. These areas may be supplied locally by small diesel plants or water wheels of sufficient capacity to furnish power to collective farms or villages.

The figures given for Region III and for Region IV are prewar figures. According to available information, these regions, which were twice subjected to military invasion and to destruction by retreating forces, suffered severe damage to power installations and transmission lines. Owing to a shortage of equipment, and to the fact that the emphasis on industrial development has apparently been shifted to the east, it is unlikely that prewar capacity will be reached in the south and southeast before the end of 1948.

(d) Region IV—Southeast (TABLE IX-46).—This region includes only the Rostov district, the area of the lower Don river. In the western part of the region are three large steam power plants at Kamensk (132), Krasny Sulin (133), and Shakhty (134), and five smaller plants, 277,000 kw. in all, included in the Dnepr-Donets transmission network (FIGURE IX-12). One other plant is known, a 1,000-kw., steam plant at Sal'sk, bringing the total known capacity for the region to 278,000 kw.

The extensive mining and industrial activities in the river Don basin are supplied by these steam power plants, which are able to draw additional power from the Shter-GRES (119) at Krasny Luch.

The greater part of the district, to the north, east, and south, is apparently lacking in both industry and power production.

(e) Region V—Volga (TABLE IX-46).—This includes the basin of the middle and lower Volga from Kazan' to the Caspian Sea.

Only a small part of the region, the area west of Stalingrad, was occupied by the Germans, so that in most cases the capacity figures are correct to 1944.

The total capacity of Region V is estimated to be 1,165,000 kw. This includes three known power plants in the city of Stalingrad (157-159) which totaled 104,000 kw. before the war. Two of these plants have been reported to be again in partial operation. The 150,000-kw. regional power station at Beketovka (160) south of Stalingrad has been reported fully restored. Four other large power plants lie within this region: Zelenodol'sk (135), 120,000 kw.; Bezymyanka (147), 100,000 kw.; Sar-GRES (153) at Saratov, 100,000 kw.; and Astrakhan' municipal plant (161), 100,000 kw.

At present all but a very small part of the generating equipment in this region is steam-powered. However, it is on this section of the Volga that the huge hydroelectric plants, Krasnaya Glinka (145), Perevoloki (149), and Kamyshin (156) are to be built with a total eventual capacity of 5 million kw. The trend in this region, therefore, is apparently toward intensive industrialization as well as toward the construction of a principal power-producing region for a large part of the USSR.

No long distance transmission lines exist in Region V as far as can be determined, but many of the power stations probably feed industrial districts through 6,600-volt networks, and in a few cases there are short 35-kv. lines.

(f) Region VI—Central Industrial (TABLE IX-46).—This region, by far the greatest in industrial development, also has the largest generating capacity, approximately 3,635,000 kw., or well over one-third of the total for European USSR. Power production is concentrated in the central and northern parts of the region, mainly in the districts of Yaroslavl', Moscow, Tula, and Gor'kiy.

The great majority of the power stations and over 80% of the total capacity are connected in the Moscow-Upper Volga transmission system (FIGURE IX-11). Probably more than half of the power produced by the plants within the network, or about 1,500,000 kw., is consumed by industries in Moscow and the immediate vicinity. It is fed into the city from the north, east, and south by multiple high tension lines, all leading into a double 110-kv. overhead line circling Moscow. From several transformer stations in this loop run 35-kv. lines forming the city network, which connects at least 11 power plants within the city.

Little is known of other city supply networks in this region, but those which may exist are probably 35-kv. or 6.6-kv. systems.

Within Region VI there are more than 100 power stations; 11 have capacities of over 100,000 kw., four of these generating over 200,000 kw. The four largest plants are at Stalinogorsk (194), Shatura (192), and Kashira (191), all in the Moscow district, and at Balakhna, Go-GRES I (209), northwest of Gor'kiy.

The first three of these plants were either destroyed or evacuated during the war, but because of their outstanding importance, particularly in the supply of power to heavy industry, they have in all probability been restored to at least their prewar capacities. The Stalinogorsk and Kashira plants are reported in full operation, and the Shatura plan was operating at over three-fourths prewar capacity in 1944. This is also true of the "ZIS" (188) and "Frunze" (184) plants within Moscow. Elsewhere in the region power installations and lines are believed to have remained largely intact.

(g) Region VII—Urals (TABLE IX-46).—This region includes only the Udmurt ASSR in the western part of the Ural Mountain area. The estimated total capacity is 170,000 kw. Four steam-powered and two hydroelectric plants (230 to 235) make up almost all of this total. These stations serve armament, machinery, and metallurgical plants in Izhevsk, Votkinsk, Glazov, and Sarapul.

The two largest and most important plants are in Izhevsk (233-234), with a combined capacity of 88,000 kw. These are connected to the station in Glazov. With this exception, there are apparently no transmission lines in the republic other than for local distribution.

(2) Transmission systems

There are four principal power networks in the European USSR: 1) the Murmansk-Kandalaksha system, which serves the electrified railway and mines and industries throughout the region; 2) the Leningrad system, serving mainly the industries in and around Leningrad; 3) the Moscow-Upper Volga system, most of whose power is consumed by industries in and near Moscow; and 4) the Dnepr-Donets system, supplying the mining and industrial region of the Donets Basin. In addition, there is a much smaller system, 70-km. double line and 20-km. single line of 110-kv., in the region of Khar'kov for the supply of local industry (FIGURES IX-9 to IX-12).

The four principal transmission systems mentioned together with the Khar'kov system, are supplied by a total approximate generating capacity of 6,243,500 kw., which represents about 66% of European USSR's total operating capacity of 9,484,500 kw. The approximate total capacities of the individual systems are: Murmansk, 236,000 kw. (3.8%); Leningrad, 1,189,000 kw. (19.0%); Moscow - Upper Volga, 2,918,000 kw. (46.7%); the fourth includes Dnepr-Donets, 1,733,500 kw. (27.8%), and Khar'kov, 167,000 kw. (2.7%).

No two of these systems are connected, according to available information, although a transmission line was planned to connect Leningrad and Moscow via Kalinin. The stage of construction of this project is unknown.

The four main networks, plus the Khar'kov system, include about 1,700 km. of 220-kv. line, of which 160 km. is double; approximately 6,000 km. of 110-kv. line, of which 1,300 km. are known to be double; and, in the Dnepr region, some 600 km. of 154-kv. line, including 160 km. of double line.

In addition to these main high tension lines there are, in some areas, considerable lengths of 35-kv. and 22-kv. line. These are shown, where known, on the accompanying diagrams. In Leningrad, and perhaps in some of the other large cities, there is an underground network of 35 kv.

Main distribution lines in industrial areas are usually at 6,600 volts. Utilization voltages are 220 and 380 volts supplying 3-phase, 50-cycle current.

Aluminum steel conductors are used for almost all of the high voltage lines. Some short 35-kv. lines are of stranded steel wire.

The 220-kv. lines are mounted on steel towers of various types, approximately 20 to 25 meters in height. Two of

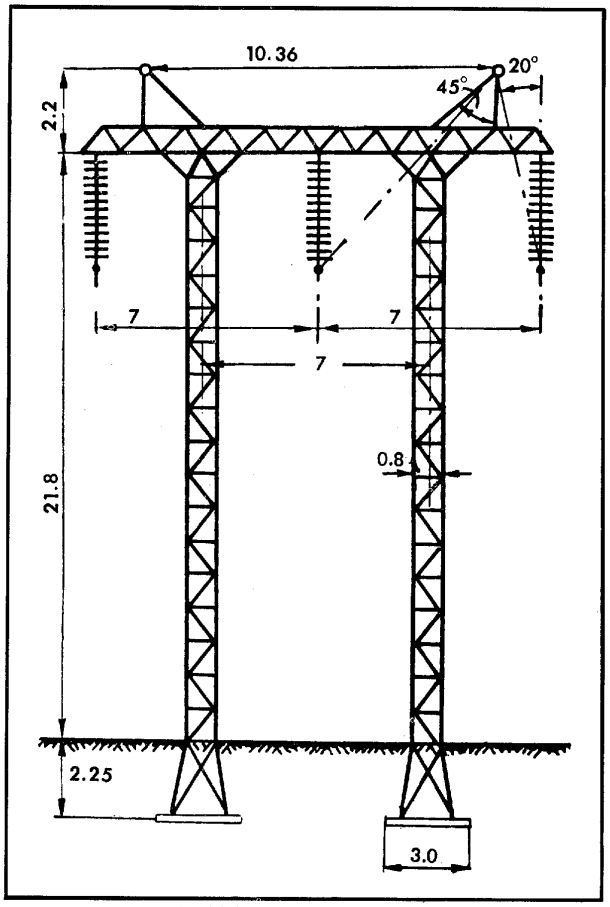


FIGURE IX-13. *Design of a steel tower in use on the 220-kv. Stalinogorsk-Moskva transmission line.* Dimensions in meters. 1937.

these are shown in FIGURES IX-13 and IX-14. A third design in use resembles the single-tower European type. Double 110-kv. lines ale also carried on steel towers; single 110-kv. lines and those of lower voltage on wooden poles or supports of the H-frame or AH-frame type.

The fourth Five-Year Plan calls for the expansion of existing high tension lines and the construction of new lines from Rogovka (south of Leningrad) to Novgorod and from Uglich to Kalyazin and Kashin, to the southwest. Transmission lines of 380 kv. and even 440 kv. are planned for the future, but these must await the completion of the gigantic hydroelectric projects of the Volga Bend and elsewhere. Finally, the connection of all the systems in the USSR is envisaged to obviate the maintenance of costly reserve capacities within the various networks against the eventuality of break-downs or overload.

These totals, and those given in the analysis of plant capacities and the location of transmission lines shown on the FIGURES IX-9 to IX-12, have been based on prewar information, modified where possible by more recent material. It is known that not only power plants, but also transmission lines operating in occupied areas suffered severe damage. However, judging from the fact that electrification is of prime importance in the economy of the USSR and from recent information on the progress of reconstruction, it is probable that the prewar level is being rapidly approached, if not already surpassed, in spite of shortages in electrical equipment.

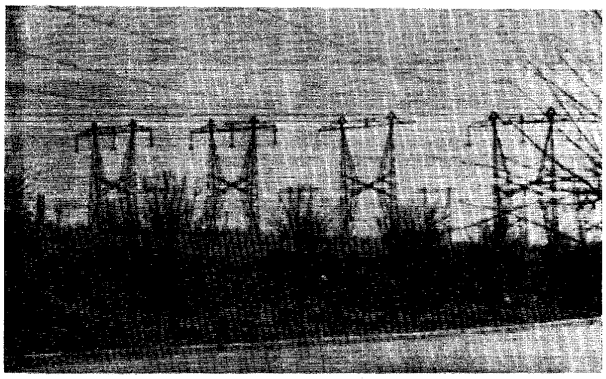


FIGURE IX-14. *High tension lines running north and south, ½ mile west of the dam at Dnepro-GES (112), Zaporozh'ye.* Towers 20 to 25 m. in height, about 225 m. apart. Before 1941.

(a) Murmansk.—The Murmansk transmission system (FIGURE IX-9), the shortest of the four systems, stretches from Kandalaksha Kaya Guba on the Beloye More (White Sea) north to the Barents Sea. It is fed by three hydroelectric and two coal-fired steam plants (2 to 5 and 7). These plants with their respective capacities are listed in TABLE IX-39. (See also TABLE IX-46.)

TABLE IX - 39

POWER STATIONS SUPPLYING THE MURMANSK-KANDALAKSHA TRANSMISSION SYSTEM

(FIGURE IX - 9)

Stations	Kilowatt capacity	
	Installed	Planned
Hydro:		
(3) Lower Tuloma (Murmashi)	50, 000	.....
(4) Upper Tuloma	48, 000	.....
(6) Niva I	.....	60, 000
(7) Niva II	66, 000	.....
(8) Niva III (under construction)	.....	120, 000
Steam:		
(2) Murmansk (H & P)	36, 000	.....
(5) Kirovsk (H & P)	36, 000	.....
Total	236, 000	180, 000

All of the above plants are connected by a 220-kv. overhead line, totaling approximately 500 km. There is also a 110-kv. line from Niva III to Kandalaksha. The power is used to operate the Murmansk-Kandalaksha Railway and to supply mines and industries throughout the area, including the city of Murmansk.

Little is known of the current supply for towns and small consumers, but it is reported to be 220 and 380-volts, 50-cycles, 3-phase. The current supply of Murmansk has been reported as 120 volts, a.c.

The Murmansk-Kandalaksha electrified railroad, 278 km. in length, is reported to be operating on 3,000 volts d.c. with overhead catenary contact. Work is in progress to electrify the line south to Loukhi, an additional 167 km.

(b) Leningrad.—The Leningrad transmission system (FIGURE IX-10) is a highly important one, in view of the high concentration of technical and machine industry in Leningrad. This industrial region is served by a 110-kv. network and by a 220-kv. line from the hydroelectric stations on the River Svir' (19, 20). These are joined through the transformer station "South," near the city, making this installation a critical point in the system from a standpoint of both operation and vulnerability.

TABLE IX - 40

POWER STATIONS SUPPLYING THE LENINGRAD TRANSMISSION SYSTEM

(FIGURE IX - 10)

Stations	Kilowatt capacity	
	Installed	Planned
Stations outside Leningrad		
Hydro:		
(19) Svir' II (under construction)	.....	180, 000
(20) Svir' III	96, 000	.....
(21) Volkhov	66, 000	.....
(24) Raukhialu	96, 000	.....
(25) Enso	50, 000	.....
Steam:		
(23) Dubrovka	200, 000	.....
(26) Regional I	114, 000	.....
(30) Regional V	110, 000	.....
(32) Kirov	120, 000	.....
Total outside Leningrad	852, 000	180, 000
Stations within Leningrad		
Steam:		
(27) Regional II	70, 000	.....
(28) Regional III	9, 500	.....
(29) Regional IV	60, 000	.....
(31) Regional VI	4, 000	.....
(34) "Bol'shevik" Armament Plant	84, 000	.....
(35) "Vasil'yevskiy Ostrov" (new)	48, 000	.....
(36) "Vasil'yevskiy Ostrov" (old)	7, 500	.....
(37) H & P, Meat Combine	25, 000	.....
(38) "Treugol'nik" rubber factory	10, 000	.....
(39) H & P plant "Nevski" works	9, 000	.....
"Krasnoye Znamya" H & P	8, 000	.....
"Pyrokslin" powder factory	2, 000	.....
H & P plant	.....	.....
Total within Leningrad	337, 000	.....
Grand total Leningrad system	1, 189, 000	180, 000

The system includes some 800 km. of single 110-kv. line (including the 185 km. to Enso); about 110 km. of double 110-kv. line; and the 290 km. 220-kv. line from Svir' II to the "South" transformer station. The network is served principally by the plants listed in TABLE IX-40. (See also TABLE IX-46.)

Within Leningrad there are 12 additional steam plants, operated mostly by individual factories which are connected in a 35-kv. underground cable network. This network is also fed by the Kirov (32) and Regional V (30) plants.

The total in TABLE IX-40 is a minimum, since some of the other large factory plants in the city may be in the 35-kv. net. Also, the Svir' II plant (19), whose equipment was evacuated to Molotov at the outbreak of the war, and whose construction was resumed in October 1946, may be in partial operation. To further increase the power supply, a hydroelectric project (22) is under way on the river Volkhov south of the Volkhov plant (21), with a planned capacity of 50,000 kw.

(c) Moscow - upper Volga.—The Moscow - upper Volga transmission system (FIGURE IX-11), is the longest and most important in the Soviet Union. Its relative importance is likely to increase, since the initial projects under the Great Volga Plan, the most ambitious hydro projects ever undertaken, will probably be tied in with this system.

The network lies roughly within the triangle formed by the cities of Shcherbakov (Rybinsk), Stalinogorsk, and Gor'kiy. Although the entire region is fairly well industrialized, the bulk of the generated power feeds the great concentration of industry in Moscow. Most of this power comes from Shcherbakov (170) and Uglich (174) to the north and Stalinogorsk (194) and Kashira (191) to the south by double 220-kv. overhead lines, and from Shatura (192) to the east and Kashira by multiple 110-kv. lines, all feeding, through several large transformer stations, into a double 110-kv. loop surrounding the city. This loop also connects, and is fed by, four large plants and several smaller ones within the city itself. The main junction points in the Moscow power supply system are the transformer stations at Reutov, Butyrki, Kozhukhovo, and Karacharovo, where the overland lines enter the loop.

The western part of the network is connected by 110-kv. lines through the power plants in Shcherbakov, Yaroslavl', and Ivanovo with the power stations and industries in the Gor'kiy region and farther south on the river Oka.

The stations supplying power to the Moscow - upper Volga system, with their respective capacities, are listed in TABLE IX-41. (See also TABLE IX-46.) Plants are steam-powered unless otherwise noted.

TABLE IX - 41

POWER STATIONS SUPPLYING THE MOSCOW - UPPER VOLGA SYSTEM

(FIGURE IX-11)

Stations	Kilowatts
Identified stations:	
(170) Shcherbakov (Rybinsk) (hydro)	165, 000
(173) Yar-GRES, Yaroslavl'	87, 000
(174) Uglich (hydro)	110, 000
(176) Mo-GES III	150, 000
(180) Mo-GES I	125, 000
(182) "VTI" H & P	70, 000
(183) "Stalin" H & P	75, 000
(188) "ZIS" H & P	75, 000
(191) Mo-GES IV, Kashira	220, 000
(192) Mo-GES V, Shatura	225, 000
(194) Stalinogorsk	350, 000
(197) Tula	60, 000
(204) Komsomol'sk	124, 000
(209) Go-GRES I, Balakhna	204, 000
(210) "Sormovo" II and P, Gor'kiy	100, 000
(212) Go-GRES II, Gor'kiy	124, 000
Total	2, 264, 000
Other stations:	
10,000–50,000 kilowatts	569, 800
2 under construction in Moscow, 24,000 kilowatts each	48, 000
Under 10,000 kilowatts	36, 200
Total other stations	654, 000
Grand total	2, 918, 000

(d) Dnepr - Donets.—The Dnepr - Donets transmission system (FIGURE IX-12) consists of two main parts, with the eastern or Donets region having a much more highly developed network. Here the main overland lines are at 110 kv., with several shorter lines at 22 to 38 kv. This system, centering on the large steam-power plants, Zuyevka (124) and Shter-GRES (119), contains several complete circuits and constitutes a modern and highly efficient network including many large generating plants.

The western or Dnepr region represents an entirely different picture. No network exists, except within the cities of Zaporozh'ye and Dnepropetrovsk. There are only two very large power stations, the great Dnepro-GES (112) at Zaporozh'ye and the Dneprodzerzinsk plant (108), west of Dnepropetrovsk. The transmission lines carry 154 kv.,

connecting the above-mentioned plants with smaller installations to the west and southwest.

These two parts of the system are connected by a 220-kv. overhead line from Zaporozh'ye to the Zuyevka station (124) at Khartsyzsk, a distance of 255 km. This line makes it possible for the Dnepr station to transmit a large surplus of power in flood seasons, so that the steam plants in the Donets system can shut down for maintenance and resume operation when the river Dnepr falls.

The coordinated control of the entire Dnepr-Donets system from a dispatching office at Gorlovka was planned in 1940. This office was to be connected by separate wire and by radio with all stations. The war and the present shortage of electrical equipment may have prevented the carrying out of the project, but it is to be expected that it will be accomplished within the next few years.

Near Kremenchug, on the Dnepr above Dnepropetrovsk, surveys have been made for a huge hydro station (101) to be linked with Dnepro-GES, Khar'kov, and Kiev. The planned capacity is said to be 600,000 kw. with an annual production of 1,500,000,000 kw.-hr.

The power stations supplying the network are listed in TABLE IX-42. They are steam driven unless otherwise noted.

TABLE IX - 42

POWER STATIONS, DNEPR - DONETS AND KHAR'KOV SYSTEMS

(FIGURE IX-12)

Stations	Kilowatt capacity	
	Installed	Planned
Dnepr-Donets system:		
(101) Kremenchug	.....	600, 000
(108) Dneprodaerzhinsk	198, 000	.....
(111) Krivoy Rog	50, 000	.....
(112) Dnepro-GES (hydro)	72, 000	513, 000
(115) Sevdon-GRES	65, 000	.....
(119) Shter-GRES	152, 000	.....
(124) Zuyevka	350, 000	.....
(126) Kurakhovka	100, 000	.....
(132) Kamensk	50, 000	.....
(133) Nesvetay	100, 000	.....
(134) Shakhty-Artem-GRES	95, 000	.....
Stations 10,000–50,000 kilowatts.	428, 000	.....
Stations under 10,000 kilowatts	73, 500	.....
Total capacity of system	1, 733, 500	1, 113, 000
Khar'kov system*:		
(104) Khar'kov plant 1	26, 000	.....
(105) Khar'kov plant 2	53, 000	.....
(106) Khar'kov plant 3	40, 000	.....
(107) Chuguyev	48, 000	.....
Total capacity of system	167, 000	.....

* A small and entirely separate transmission system connects the four plants in the Khar'kov region and serves the cities and industries in the surrounding areas.

(3) Distribution networks (TABLE IX-46)

Information pertaining to distribution systems and power resources within the network of cities has been limited.

In Leningrad a 35-kv. underground grid connects 12 local power stations whose total installed capacity is approximately 206,000 kw. Additional power is supplied to this grid from the Kirov (32) and GRES V (30) regional steam stations, which are located a short distance from the city. These regional stations are tied in with the incoming high-voltage transmission lines from other stations to form the balance of the power supply to the Leningrad network. The total capacity of the network amounts to approximately 1,189,000 kw. Several important large outdoor transformer and switching stations are located on the outskirts of Leningrad for stepping down and controlling the power supply of the 110 and 220-kv. lines and the Kirov and GRES V stations (FIGURE IX-10).

The power supply of Moscow and surrounding area amounts to over 1,500,000 kw. A double 110-kv. loop encircles the city, and this in turn is fed by incoming transmission lines that terminate on the outskirts of the city. Large stations, namely, Uglich (174), Shcherbakov (170), Stalinogorsk (194), Kashira (191), Shatura (192), Mo-GES III (176), and others supply power to these transmission systems. Within the city there are 11 known plants, totaling over 500,000 kw. of capacity connected to the above loop network. Large outdoor transformer and switching stations are located at feeding points to the loop and control the energy supplied to the secondary distribution systems. These systems redistribute the power and step down the tension to utilization voltages (FIGURE IX-11).

In the Gor'kiy area the Balakhna regional steam station (209), the three steam plants in Gor'kiy (210 to 212), and the stations at Dzerzhinsk (213) and Balakhninskaya (208) are the primary feeders to the 110-kv. transmission system which supplies power to this region. Several transformer stations located at strategic points in the network step down the incoming voltage to 35 kv. for transmission to load centers, where it is redistributed to local industries and other consumers at utilization voltages (FIGURE IX-11).

The city of Ivanovo is supplied by two 110-kv. lines from Komsomol'sk (204) and two steam plants (205, 206) located in the city. These transmission lines have ties with the Yaroslavl' and Gor'kiy districts and other smaller stations. Transformer stations step down the voltage to 35 kv. which is used to supply the city and industries. One of the 35-kv. cables is underground (1.5 to 2 meters deep) and feeds direct to the municipal theater and the Katonin rope factory (FIGURE IX-11).

The Khar'kov area has a total capacity of approximately 167,000 kw. It is supplied by a double 110-kv. transmission line (70 kilometers) from Chuguyev (107) and by three stations in Khar'kov (104 to 106). These lines lead into two large transformer stations which redistribute the lower voltage to the city and to the factories in the surrounding area (FIGURE IX-12).

The distribution network of Tula (197) consists of several transformer stations with voltage ratings of 110/35/6.6 kv. One of the stations consists of three single-phase units with a total capacity of 60,000 kv.-a. The metal combine, located in the area, is probably served by a 35-kv. line. Other industries and the power demands of the city receive their supply from the 35/6.6-kv. network (FIGURE IX-11).

The cities of Stalinogorsk (194) and Yaroslavl' (172, 173) are supplied by medium tension lines. The output of the Yar-GRES (173) plant in Yaroslavl' is utilized within the city. It is tied in with two incoming transmission lines and with the heat and power station operating in the city. A large transformer and switching station controls and redistributes the reduced voltage to the area network, reported to have a tension of 6.6 kv. (FIGURE IX-11).

Extensive distribution networks have been constructed to supply the heavy industry that has developed in the

areas of Zaporozh'ye and Dnepropetrovsk. The two cities are connected by a double 154-kv. transmission line. Additional lines of 154 and 220 kv. are connected to the system at Zaporozh'ye. A double 154-kv. loop encircles the city of Zaporozh'ye. In the loop are located four transformer stations. A large switching and transformer station, also in the loop and located on the outskirts of the city, controls the 220-kv. supply. At Dnepropetrovsk, a single 154-kv. loop feeds the area. Within this area there are three transformer stations and three small stations feeding into the loop. One of these transformer stations, located south of the city of Uzlovaya, controls the incoming 154-kv. lines that form the main power supply of the region (FIGURE IX-12).

(4) Thermal plants

(a) Steam plants.—Approximately 82% of the total electric power output of the European USSR is produced by steam power plants, and of this percentage over 85% is produced by peat and low grades of coal. Most of the largest power stations operate on local fuel, and this supply accounts for over four-fifths of the total tonnage consumed. Peat is fired chiefly in the Shatura (192), Gor'kiy (210), Krasny Oktyabr (30), and Dubrovka (23) stations. Anthracite culm is fired in the Shter-GRES (119), Zuyevka (124) (FIGURE IX-15), Beketovka (Stalingrad) (160), and Shakhty-Artemovskiy-GRES (134) stations, Moscow coal (brown coal) is fired in the Kashira (191), Mo-GES I (180) (FIGURE IX-16), and Stalinogorsk (194) stations.

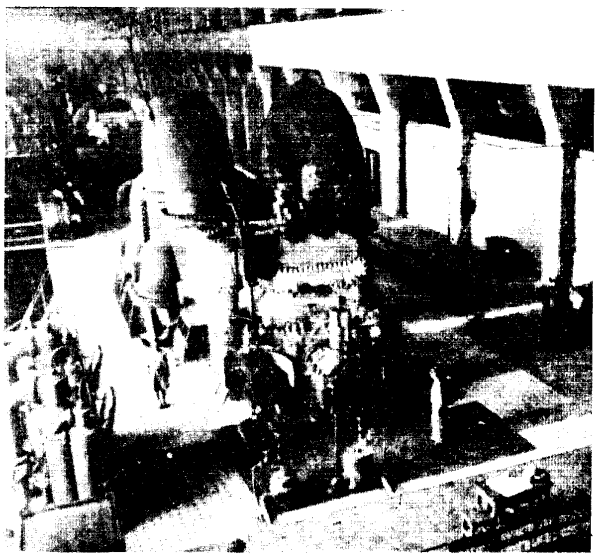


FIGURE IX-15. *Zuyevka (124) steam power plant at Khartsyzsk, Ukrainian SSR.*
Machine room, restored in 1946. Before 1941.

The standard capacity for condensing steam stations at the beginning of the second Five-Year Plan was a 50,000-kw. turbogenerator unit. Recent reports state that as high as 100,000-kw. units have been built by the Khar'kov and Leningrad manufacturing plants. Turbines rated at 44,000 to 50,000 kw. have been operating in the Kashira, Dubrovka, Zuyevka, Shatura, Krasny Oktyabr', Shter-GRES, Gor'kiy, and Stalinogorsk stations. The capacities and percentages of the turbogenerator units installed by 1935 were: up to 12,000 kw., 30.5%; 12,000 to 25,000 kw., 35.8%; 25,000 to 50,000 kw., 23.2%; and over 50,000 kw., 10.5 percent.

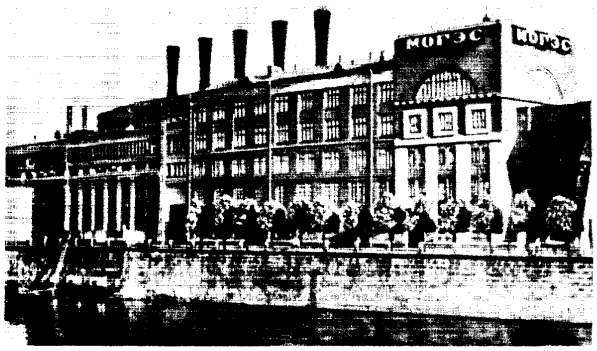


FIGURE IX-16. *Mo-GES I ("Smidovidh") (180) municipal steam power plant in Moscow.*
Central control station of the Moscow power system. 1941.

The principal types of boilers used in the large capacity generating stations are units of 16,000 to 27,000 square feet of heating surface. The boilers installed in the Kashira plant have a heating surface of 33,400 square feet and a steaming capacity of 423,000 pounds per hour. Other large stations have steaming capacities ranging from 265,000 pounds to 353,000 pounds per hour. Most of the boilers employ water-cooled furnace walls to increase their steaming capacity, especially those using lump peat. A straight-flow, sectionalized single-drum boiler generating 441,000 pounds of steam per hour at a pressure of 1,850 pounds per square inch has been operating in the H and P (heat and power) station of the Union Heat Engineering Institute in Moscow (VTI 182). Steam pressures ranging from 853 pounds to 1,850 pounds per square inch with temperatures from 797° to 932° F. are widely used in Soviet power stations. Chain-grate stokers are used for firing peat and anthracite culm, and for Moscow coal the inclined shaking grate stoker (Seyboth) is used in small and medium capacity boilers (88,000 to 132,000 pounds of steam per hour). The reported efficiency of boilers burning milled peat is 82%, lump peat 88%, and those using anthracite culm, 84 percent.

The lay-out of the Iv-GRES regional peat-firing station (204) is shown in FIGURE IX-17. The parallel arrangement of boiler and turbine rooms affords several advantages: the compactness of the main equipment; short steam and water lines; simplicity of the steam, water, and electric connections; and ease of servicing. All recent designs of peat-firing stations for medium capacity turbogenerators have followed this scheme of parallel lay-out.

The Makar'yev type of boiler is generally used to fire lump peat, oil shale, and milled peat. According to the Soviet information, these boilers operate reliably and economically, and their efficiency approximates that of oil-fired boilers.

The Ramzin direct-flow high-pressure boiler has recently been adopted for installation in Soviet plants. It is a smaller unit for the steaming capacity output than the equivalent types of other boilers in use. Some of the features claimed for this boiler are that it can be constructed on the site and burns from 12% to 14% less fuel than other similar capacity boilers. During the war the Ramzin boiler was extensively used to speed new construction or reconstruction of evacuated power plants. In 1943 Ramzin was awarded the Order of Lenin and a prize of 150,000 rubles for outstanding achievement in thermodynamics, which attests to the value the Soviets placed on his boiler.

In addition to steam-electric power generating plants, heat and power (H and P) stations have been developed

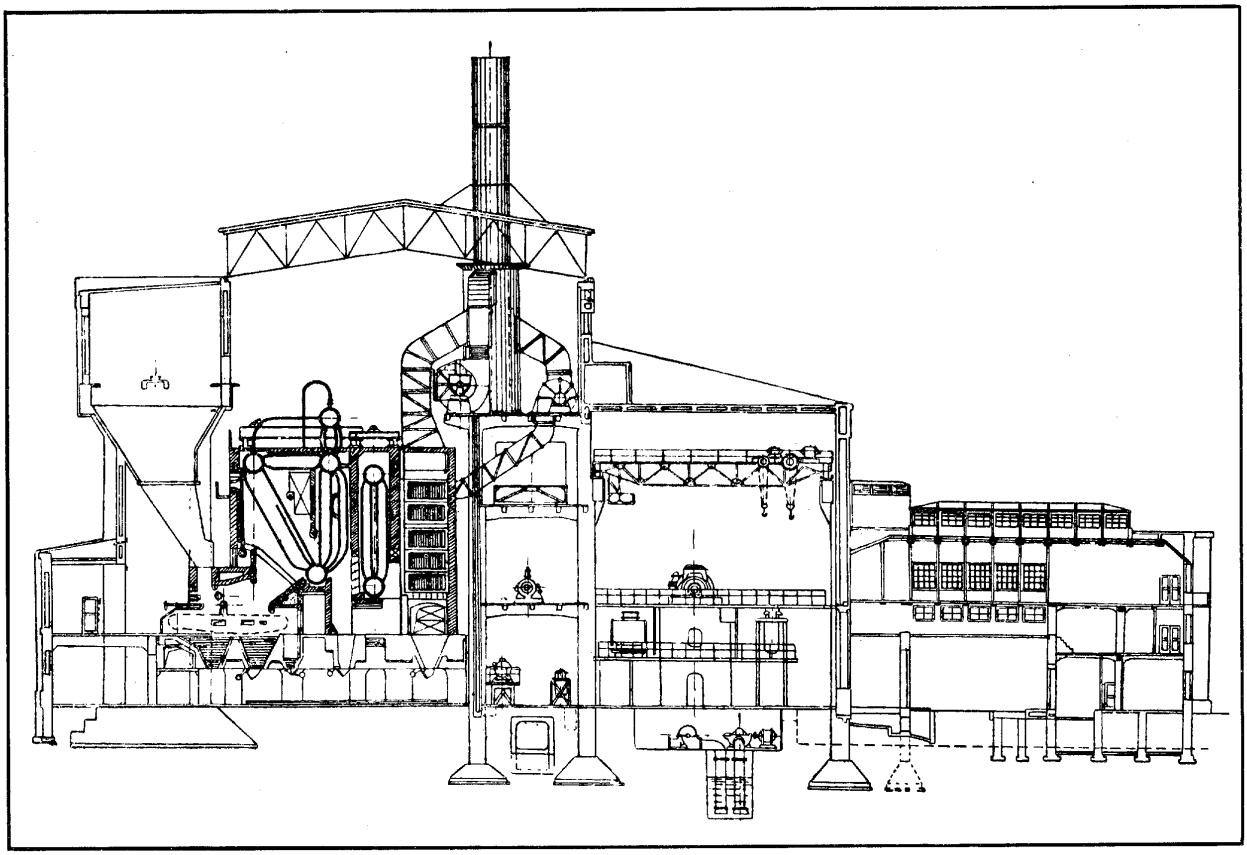


FIGURE IX-17. *Plant lay-out of the Iv-GRES (204) steam power plant at Komsomol'sk. 1937.*

in the USSR to over 1,500,000 kw. of capacity. These stations supply heat and electricity to the surrounding domestic consumers, besides supplying the industrial enterprises for which they were originally constructed. At the same time they feed into the regional electric networks, acting as base load stations of planned power systems (FIGURES IX-10 to IX-12).

Industrial heat and power service has been widely developed, supplying heat as steam or hot water to big factories for industrial process purposes, as well as for heating and ventilating factory buildings.

At the present time, Moscow, Leningrad, Khar'kov, Rostov-na-Donu (Rostov-on-Don), Saratov, Kuybyshev, Ivanovo, Yaroslavl', Gor'kiy, and a number of other cities are equipped with heat and power service. The heating networks of Moscow and Leningrad are over 60 km. each.

(b) Internal combustion engines.—The internal combustion engine is used to only a slight extent in the production of electric power in European USSR. Several diesel plants of small capacity have been reported as operating in the area. Stations of small capacity in the Baltic States have been reported as diesel-operated plants. The largest plant in the western part of European USSR is the power plant at Borovichi (42) with a capacity of 7,000 kw. and partly operated by diesels. Other diesel plants of any significance total approximately 2,598 kw. in this region. A 6,820-kw. plant operated partly with diesel power is reported for Chernovtsy (94) and a small plant under 2,000 kw. for Kishinev (southwest Ukraine).

The largest plant reported with diesel equipment in the eastern part of European USSR is the Syzran' heat and power plant (143). This plant is believed to have a capacity of between 10,000 and 20,000 kw. and has two diesels in operation.

Probably the greatest concentration of diesel-powered electric stations will be found in the cities and towns close to the Black Sea or in the lower Volga region. However, these plants are of small capacity and play a relatively minor role in the electrical power development of the country.

The Soviet government obtained diesel-powered generators from the United States both by purchase and under the lend-lease program. Three hundred and five of these plants were 200 to 500 horsepower, three-phase generators, supplying 220 and 380 volts. Two hundred units were rated at 2,000 horsepower and another 200 or more were portable generators with capacities ranging from 50 to 100 kw.

No gasoline generators have been reported in operation in European USSR. It may be safely assumed that these units represent a small fraction of the electric power generated in the country.

(c) Fuel.—Of the total electric power capacity of European USSR, 81.3% is known to be steam-powered, only 11.6% hydroelectric, and 0.2% diesel. The remaining 6.9% could not be identified as to type but is probably largely thermal. The large percentage of thermal capacity indicates the great importance of fuel supply to the electric power industry.

The USSR is self-sufficient in fuel except petroleum which is expected to be in short supply until 1950. Extensive war damage to Soviet oil fields by the Germans has resulted in a limited supply of crude oil.

Coal and peat are the principal fuels used in the generation of electricity. A large number of the stations are

using a low grade coal, especially those located in the Don and Moscow basins. Coal consumption by the electric power stations is shown in the tabulation.

Year	Consumption *Millions of metric tons* *
1940	20.1
1945	24.2
1946	25.6
1950 **	36.0

The bulk of electric energy in European USSR is produced from peat. It is plentiful and easily extracted. The peat industry is located largely in the areas formerly occupied by the Germans.

A number of thermal plants are fired with mazut. This thick, brownish black fuel oil is a residue from the distillation of kerosene and benzine.

The Baltic shale refineries add to the Soviet Union fuel stock pile, together with imports of coal from Poland as reparations, and oil from Rumania and other Russian-occupied areas. Petroleum imports from the United States have been small in comparison with the amounts available in Europe; imports declined to 350,000 tons in 1946.

Table IX-46 lists the types of fued used in most of the important power stations in European USSR.

(5) Hydroelectric resources, development, and projects

The water power resources of the Soviet Union have been estimated to be about 280 million kw. Of these resources only 0.4% had been exploited by 1940, but present plans of the Soviet government call for far greater utilization of hydroelectric power.

The vast plains and big rivers of European USSR are suitable for large, medium, or low head dams, designed to hold great quantities of water. These water storage facilities are virtually a necessity because of the inadequate rainfall which averages about 20 inches a year. Moreover, much of the annual precipitation occurs during the spring thaw creating flood conditions and causing wide variations in river levels.

Soviet authorities have placed great reliance upon hydroelectric development in the industrialization program of the Soviet Union, as a means not only of providing the country with cheaper power but of solving such other pressing problems as improvement in inland waterway navigation and irrigation of agricultural areas.

All areas in European USSR have shared in the development. In the north, Leningrad presented a power problem. The city owed its existence chiefly to the fact that it was a port. It possessed few other advantages. Prior to the revolution its coal requirement had been shipped from abroad and later its power stations depended for their fuel on Moscow lignite or Estonian bituminous shale. It is not surprising, therefore, that the first important hydroelectric station in European USSR was the Volkhov station (21) built to service Leningrad and its industries. Another station, the Svir' III (20) (Figure IX-18) was added to the Leningrad network, and the Svir' II (19) hydroelectric station is now under construction.

Farther north, in the Kola region, lies the ice-free port of Murmansk. Fuel supplies for the port and its railroad are difficult to obtain. A series of hydroelectric dams on the Tuloma (3, 4) and the Niva (6, 7, 8) rivers furnish practically all the electric power requirements of Murmansk and the electrified portion of its railroad reaching down to Kandalaksha.

* Metric ton equals 2,205 lb.

** Estimated under fourth Five-Year Plan.

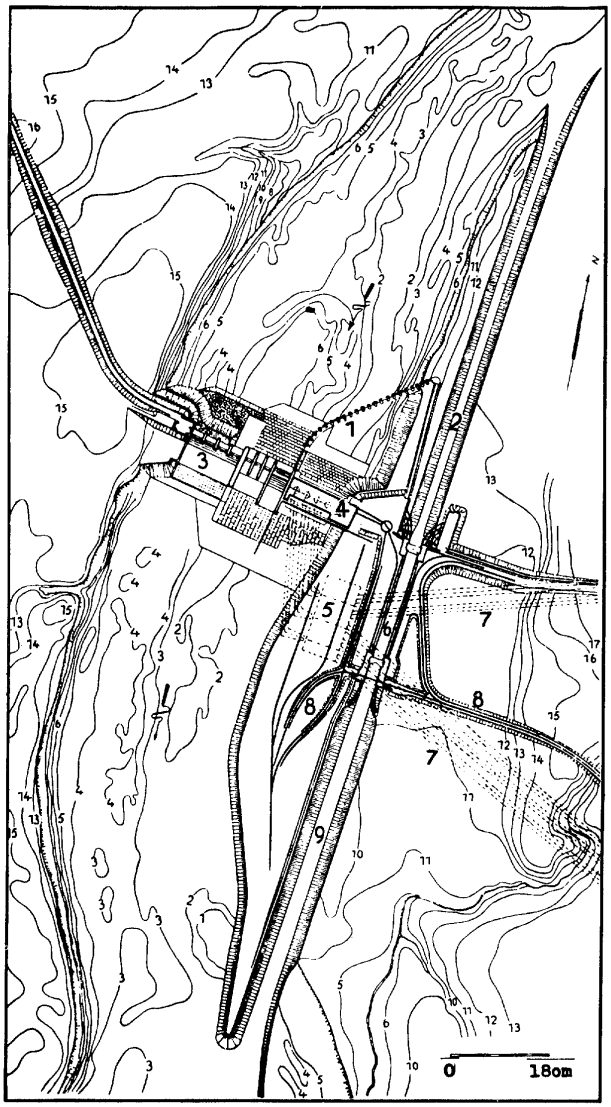


Figure IX-18. *Plan of Svir' III (Lower Svir') (20) hydroelectric station on the river Svir'.*
Elevations in meters above river bed. Before 1941.

1. Ice protection screen
2. Upper ship canal
3. Dam
4. Turbine house
5. Transformer installation
6. Locks
7. Overhead transmission lines
8. Railroad
9. Lower ship canal

In the industrial area surrounding Moscow the demand for power is considerable. At Shcherbakov (Rybinsk) (170) and Uglich (174), large dams were built which are to be an important source of power for the Moscow power net.

The best known and the largest of the Russian hydroelectric stations is the Dnepro-GES station (112) on the river Dnepr near the town of Zaporozh'ye (Figures IX-19 to IX-21). It was designed to furnish power for large steel and aluminum plants that were built around the station and was coupled to a power system intended to supply a large new industrial area in the south. Above the Dnepro-GES station on the river Dnepr at Kremenchug (101) another and larger station is to be built. This station, too, will furnish power to the southern industrial area and will have the important function of regulating the water supply of the Dnepro-GES installation.

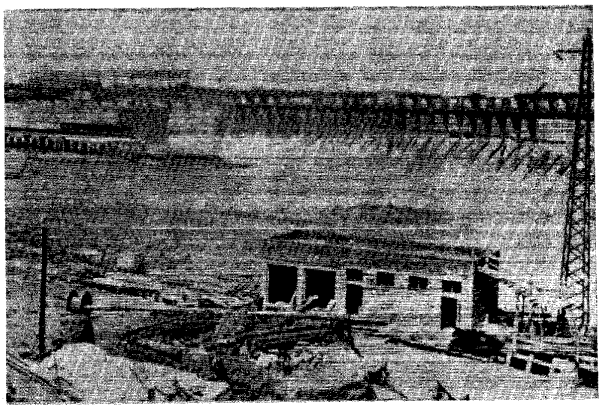


FIGURE IX-19. *Dnepro-GES (112) hydroelectric project on the Dnepr river at Zaporozh'ye.*
Powerhouse with switchyard in background, 1934.

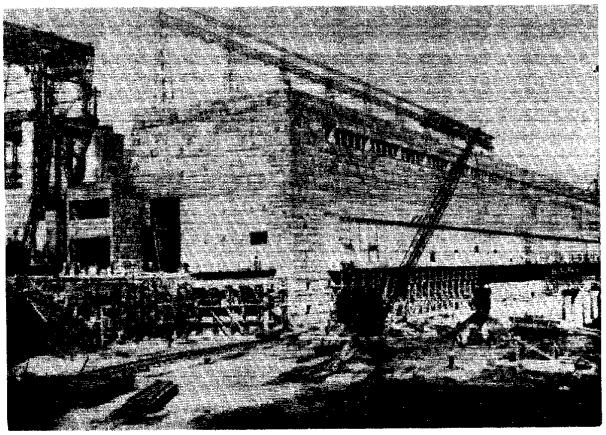


FIGURE IX-20. *Dnepro-GES (112) hydroelectric project at Zaporozh'ye Powerhouse.*
Tailrace openings lower right. 1934.

In the middle Volga area the largest of all such projects, the Kuybyshev system (145 and 149), is under way at the Samara loop. It is planned to be the largest aggregate in the world with an installed capacity of 3 million kw. and an estimated yearly output of 14,500,000,000 kw.-hr. It is intended to supply large industrial enterprises, e.g., artificial fertilizer works, railroads, etc., and even distant industrial areas such as Moscow, Gor'kiy, and the Tatar ASSR.

The development of hydroelectric power in the Soviet Union has included costly mistakes. A characteristic of the initial construction of electric plants was the design of isolated stations without sufficient attention to the co-

TABLE

IMPORTANT HYDROELECTRIC

Plant No. on TABLE IX-46	Station	Coordinates	River	Capacity installed	Output	Dam			Turbines		
						Type	Length	Head	Type	Power	Number
		° ′		*Kw.*	*Million Kw.-hrs.*		*Meters*	*Meters*		*Hp.*	
3	Murmashi (Lower Tuloma).	68 41 N 31 55 E	Tuloma	50,000	223	Unknown	Unknown	35.0	Kaplan	Unknown	4
7	Niva II	67 18 N 32 29 E	Niva	66,000	350	Earth	700 (crest)	37.0 58.0 (max.)	Francis vertical	20,500	4
20	Svir' III (Lower)	60 48 N 33 43 E	Svir'	96,000	540	Concrete on clay.	213	10.5	Kaplan vertical.	37,500	4
21	Volkhov	59 55 N 32 21 E	Volkhov	66,000	350	Concrete on limestone.	210	11.5	Francis vertical.	11,500	8
58	Kegums	56 45 N 24 40 E	Daugava (Zapadnaya Dvina).	51,000	270	Concrete	400	Unknown	Vertical	22,000 (approx.)	3
112	Dnepro-GES	47 52 N 35 05 E	Dnepr	72,000 (585,000 planned)	Unknown (2,500 prewar)	Gravity (concrete on granite).	760	36.5	Francis vertical.	100,000 (90,000 prewar)	1 (9 prewar)
168	Ivan'kovo	56 45 N 37 08 E	Volga	30,000	150 (1941)	Earth fill	8,210	14.0	Kaplan	Unknown	2
170	Shcherbakov (Rybinsk)	58 03 N 38 48 E	Volga	165,000	Unknown	Concrete (?)	150	16.0	Kaplan	Unknown	3
174	Uglich	57 32 N 38 22 E	Volga	110,000	Unknown	Concrete	170 (Main section only)	14.0	Kaplan	Unknown	2

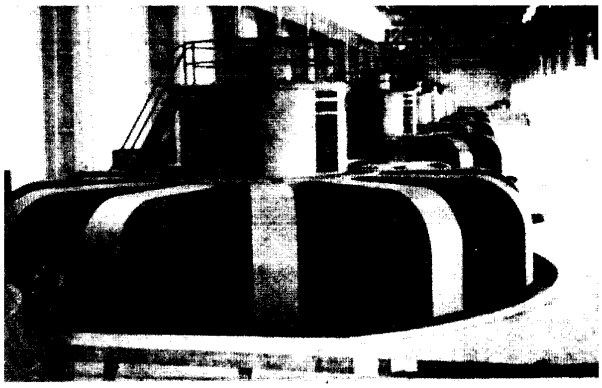


FIGURE IX-21. *Turbine room of the Dnepro-GES (112) hydroelectric station at Zaporozh'ye. Before 1941.*

ordination of the installations as part of a power system and a serious underestimation of the importance of geological survey work. As a result large dams were built without adequate water supply and others with an inadequate head.

The Volkhov dam (21), for instance, in flood periods utilizes wooden flashboards two meters high on the crest of the spillway to obtain additional power. The Dnepr dam, on the other hand, operates for most of the year at possibly less than half of the installed capacity because of the lack of water. The latter situation will be corrected by the erection of the dam at Kremenchug, which, besides furnishing electric power of its own, will act as a regulatory dam for the Dnepr and is expected to increase the Dnepro-GES power output by 150 million kw.-hr. yearly. In the meantime, to supplement the power of the Dnepro-GES station, thermal power plants were erected.

Several hydroelectric plants of considerable importance were acquired with the annexation of territory formerly belonging to Finland and Germany. In the Karelian Isthmus, close to the present border, are two large hydroelectric stations on the Vooksi (Vuoksi) river at Enso (25) and Roukhiala (24) (FIGURE IX-22). Their capacities are 50,000 and 96,000 kw., respectively. Both were destroyed during the war but have been restored and are furnishing power to Leningrad, 160 km. to the southeast. The installation of a third, 25,000-kw. turbine at Enso has been reported which would raise the capacity to 75,000 kw. On the Alle river in the Kaliningradskaya Oblast' (formerly part of East Prussia) are two hydroelectric stations at Gross Vonsdorf (75) and Pravdinsk (76). The former is quite small, but the Pravdinsk station, shown in FIGURE IX-23, has a capacity of 10,000 kw. It is equipped with four horizontal Francis twin turbines, three of 5,400 horse-

IX - 43

STATIONS IN EUROPEAN USSR

Generators				Year started (operation)	Remarks
Make	Capacity	Voltage	Make		
	Kw.	*Volts*			
Unknown....	Unknown..	Unknown..	Unknown..	1937	Supplies power to Murmansk-Kandalaksha R.R. and Murmansk industry. Connected to Upper Tuloma and the Niva stations by 220-kv. line. In winter capacity falls; load taken by Niva II. (FIGURE IX-9.)
USSR.....	15,000	11,000	USSR.....	1934	Connected to Murmansk transmission system. Supplies power to Kandalaksha, Monchegorsk, and Kirovsk, with their aluminum and copper-nickel combines, the apatite mines, and the Kandalaksha-Kirovsk R.R. sector. Supplies Murmansk in winter. (FIGURE IX-9.)
1-USSR..... 3-Swedish...	24,000	11,000	USSR.....	1933	Peak-load power plant of Leningrad energy center. Direct feed by 220-kv. line to "South" transformer station, Leningrad (280 km.). Together with Volkhov station (below), furnishes nearly half the power needs of Leningrad. Reconstruction: two turbines again operating October 1946. (FIGURE IX-10.)
Swedish.....	7,000	11,000	4-Swedish.. 4-USSR....	1926	First large hydroelectric station in the USSR. Connected by 110-kv. lines to Region V (Krasny Oktyabr') plant and transformer stations "North" and "South" in Leningrad. Supplies aluminum industry and others. Lower peak-load station for Leningrad. (FIGURE IX-10.)
Unknown....	17,000	88,000	USSR.....	1936	Main supply for Rīga. Lines at 88 kv. to Rīga, Jelgava, Jeriki; other lines to Bauska, Daugavpils, Saldus, Talsi, Valmiera. (FIGURE IX-63.)
U.S.A. (same prewar).	72,000 (62,000 prewar).	Unknown (13,800 prewar).	U.S.A. (prewar: 5, U.S.A.; 4, USSR).	1947	Operation begun in 1932. Entire plant destroyed by Germans. One generator in operation (March 1947). Second generator scheduled for October 1947 and third before end of year. The three initial units are of American manufacture; the six remaining units to be built by USSR. All nine units are scheduled for installation by end of 1950. Eventual capacity 585,000 kw. Feeds Dnepr-Donets transmission system (FIGURE IX-12). Supplies power to Donets Basin in high-water periods.
Unknown....	15,000	Unknown..	Unknown..	1937	About 3 km. northwest of Ivan'kovo on right bank of Volga at storage dam for Moscow-Volga Canal. 17-meter falls. 110-kv. line to Moscow via Butyrki; 35-kv. line to Kimry. (FIGURE IX-11.)
Unknown....	55,000	Unknown..	Unknown..	1941	On west bank of the Sheksna at its outflow from the Shcherbakov, Rybinskoye Vodokhranilishche Reservoir, 3 km. northwest of Shcherbakov. (Length of dam as given refers only to main part; earth dams on either side unknown.) Important source of power for Moscow; 220-kv. line to Moscow via Uglich. Capacity has been reported as 220,000 kw. Planned capacity 330,000 kw. Belongs to Yaroslavl' Power System. Also supplies Shcherbakov district and Yaroslavl'. (FIGURE IX-11.)
Unknown....	55,000	Unknown..	Unknown..	1939	Between Shcherbakov and Ivan'kovo. Important power source for Moscow. Double 220-kv. line to Moscow. Planned capacity: 220.000 kw. 90% of power goes to Moscow. (FIGURE IX-11.)

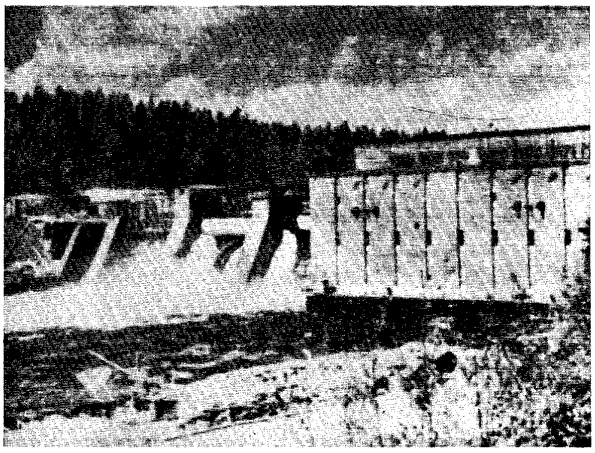


FIGURE IX-22. *Räukhiala (24) hydroelectric plant on the river Vuoksa in former Finnish territory. Before 1941.*

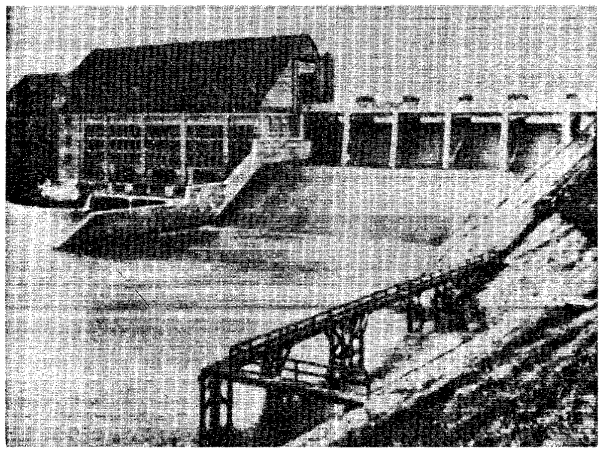


FIGURE IX-23. *Pravdinsk (76) hydroelectric plant on the river Alle in former East Prussia, 1930.*

power and one of 2,100 horsepower with direct-coupled generators. It is connected with Gross Vonsdorf and Kaliningrad (Königsberg) and with Elblag, in the Polish section of East Prussia (TABLE IX-46).

TABLE IX-43 includes selected important hydroelectric plants operating in European USSR.

The hydroelectric stations of Dnepro-GES and Svir' III and the projected Kuybyshev installation are described below. The operating characteristics and plant details are given for the two stations in operation, and some details are presented on the construction and the planned capacity and output of the Kuybyshev project.

(a) Dnepro-GES station (112).—This plant is located on the Dnepr river several miles above the city of Zaporozh'ye. It is the largest hydroelectric station in the Soviet Union. Construction was begun in 1927 and completed in 1932 (FIGURES IX-19 to IX-21).

The station was heavily damaged during the war. All the equipment in the power house was destroyed, and the dam was breeched in several places.

The work of rebuilding the plant started in March 1944 and the first generator began its trial runs in March 1947. The new turbines and generators are intended to be more powerful than the originals (TABLE IX-43). Plant characteristics and statistics are as follows:

Dam: Concrete gravity type, slightly curved in form. Total length across the river is 760 meters. Maximum head 36.5 meters.

Flow: Fluctuates between 300 cubic meters per second at minimum low water and 21,795 cubic meters per second at maximum high water.

Powerhouse: Alternators, nine units (prewar) 77,500 kv.-a. (62,000 kw.) each at 0.8 power factor. One unit (postwar), 90,000 kv.-a. (72,000 kw.), reported in operation (March 1947). Two others to be commissioned by the end of the year.

Turbines: Nine units, vertical shaft, single flow Francis. Prewar horsepower, 90,000. Postwar horsepower, approximately 100,000.

Transformers: (Prewar) 77,500 kv.-a. transformer bank for each generator. The generated voltage of 13,800 volts was stepped up to 154 kv. for transmission (FIGURE IX-12). Each bank consisted of three outdoor single-phase units, 26,000 kv.-a. capacity each, and used forced oil as a cooling agent. Postwar units are to be similar except that kv.-a. capacities will be raised.

Total capacity: Prewar, 558,000 kw. Planned postwar, 585,000 kw.

Output: Prewar, original estimate was 2,500,000,000 kw.-hr., actual power production was probably lower. Planned postwar, 3,000,000,000 kw.-hr.

Remarks: Owing to the large variations in the river flow, the power plant can be fully utilized for only 75 days in the year. One source states that a small reservoir up the river is used for water storage which builds up the total power output somewhat. A larger hydroelectric station about 300 km. up the river, near Kremenchug, is being planned and will act as a storage and regulating reservoir for the Dnepro-GES station.

(b) Svir' III (Lower) station (20).—This station began initial operation in 1934. It was the second hydroelectric installation completed for the supply of electric power for Leningrad and its industries. The Volkhov (21) hydroelectric plant was the first plant constructed and began operating in 1926. The Svir' III station is located on the river Svir' 143 km. from Lake Ladoga. During the war the plant was captured by Finnish troops who damaged the installation and wrecked the equipment. Shortly after the site of the plant was recaptured, the work of rebuilding was started. In March of 1946 the first turbine began operating, and the work of restoration has been completed since that time (TABLE IX-43).

The plan of the station is shown in FIGURE IX-18. It shows the location of the generating building, the outdoor transformer station, and the high voltage overhead transmission lines emanating from the power supply.

The characteristics of the plant are as follows:

Dam: Concrete dam, 200 meters long with a head of 10.5 meters united on the right bank to an earth dam approximately 1 km. long. The powerhouse is on the same axis as the dam and is actually an integral part of the dam.

Flow: Mean flow is 674 cubic meters per second. Winter (low water) period flow falls to 400 cubic meters per second normal minimum and has reached the low of 130 cubic meters per second. Summer (high water) flow reaches 1,300 cubic meters per second and has reached 1,800 cubic meters per second.

Power plant: Alternators, four three-phase synchronous alternators on the same axis as the turbines with a maximum power of 30,000 kv.-a. The original units were built by "Electrosila" in Leningrad. The restored units are probably of the same design and capacity.

Turbines: Four vertical Kaplan turbines rated at 37,500 horsepower. Three of the original units were built in Sweden and were of Swedish design. One was partly built in Leningrad.

Transformers: Four banks of transformers with a maximum capacity of 20,000 kv.-a. The voltage is stepped up from 11 kv. to 220 kv. for transmission to Leningrad by a trunk feeder (FIGURE IX-10).

Remarks: The site of the works had been determined by the necessity of disposing works in a broad section of the river, to avoid disruption of river traffic during the period of con-

struction. The plant was designed to produce 550,000,000 kw.-hr. Its actual production may be less than that. It is now used to supply the peak power requirements of Leningrad.

(c) Kuybyshev project (145 and 149).—This project, planned to be the largest hydroelectric installation in the world, has been under construction since 1937. The war interrupted the project and little has been said about work resumption since the end of the war. One Soviet officer remarked that the Kuybyshev installation may never be completed because of Soviet reluctance to concentrate so much of their power supply in a comparatively small area. Another unstated reason for supposing that the project has been indefinitely postponed is a possible reaction to "gigantism," a matter which was the subject of one of Stalin's speeches prior to the war. On the other hand, much of the planning for the lower and middle Volga area has depended upon the existence of a large power-producing plant, and since so much of the project should have been completed before the invasion, it seems very likely that the original plans will be carried out.

The entire set-up lies at the "Samara Loop" of the Volga about 300 km. below the mouth of the Kama. Two series of dams are planned. The plant at Krasnaya Glinka is to have a concrete overflow dam, 950 meters long and 45 meters high, with 32 arches. On the left bank are the hydroelectric works, 335 meters long, and on the right are the locks. The electric station is to have ten Kaplan turbines each of 175,000-kw. capacity. The other plant will be located at Perevoloki where a double canal is to be cut, one for shipping and the other for the hydroelectric station. Seven 175,000-kw. turbines are planned for this dam.

In years of abundant water, up to 15,500,000,000 kw.-hr. yearly production may be expected, and in poor years at least 9,500,000,000. A stand-by steam plant with a capacity of over 1,000,000 kw. is planned for production in dry years.

In connection with the hydroelectric plants, large industrial enterprises are planned, e.g., artificial fertilizer works for the surrounding agricultural areas. A series of railroads passing through or starting at the Volga area will change over to electricity. The stations are intended to supply the industrial areas around Moscow, Gor'kiy, in the Tatar ASSR, and in the new oil region between the Volga and the Urals. For this, the use of transmission systems of up to 440 kv. is being investigated.

(6) Consumption of electric power

TABLE IX-34 presents the available information on prewar consumption of electric power by the various branches of Soviet economy, with estimated figures for 1950. No statistics are available on the wartime or present pattern of consumption.

The table shows that municipal electrification has not kept pace with the electric power development of the country. Industry, transport, and rural economy have remained in approximately the same relationship, with industry consuming by far the greatest portion of the generated power. The percentage consumed by industry was undoubtedly even larger during the war, one estimate for 1943 being as high as 75 percent.

The small share of domestic users in the total output is a reflection of the great emphasis on industrialization, both for national defense and as a prerequisite for the development of the national economy as a whole. In view of the tremendous set-back in both industry and electricity production occasioned by the war, this emphasis might be expected to increase. However, in the plan for 1950, it is the rural economy which is to make the greatest proportionate advance in electrification. This increase is probably conditional upon the successful development of power supply to industry.

The western and southern regions will suffer the most severe shortages in electric power. Power stations and transmission lines must be repaired and rebuilt before even industrial needs can be fully met, and municipal and rural consumers will probably receive no appreciable increase in their supply until 1950 or later.

In the other regions, power output is apparently adequate for industrial needs, with a somewhat greater surplus for domestic use than was available during the war years.

(7) Available surplus over peak loads

Information on the wartime operation of the Soviet electric power industry is not entirely clear. It has been estimated that approximately 6,000,000 kw. of power equipment were destroyed or evacuated during the war. This amount represents more than half of the installed capacity on hand at the beginning of the war. The Dnepro-GES hydroelectric station (112) and the Zuyevka steam station (124), the largest power stations in the USSR, were included in the occupied areas. In addition to these, many others in the west and south and in the Leningrad region were either completely destroyed or badly damaged. It has been estimated that one million kw. were evacuated to the east.

By the end of 1945 the Soviet electric power industry had practically regained its total prewar capacity. In European USSR only the Central Industrial and Volga regions have been restored to prewar capacity. The North and Northwest, West, South, and Southeast Regions will probably not regain their former capacity until late in 1948.

All regions under the fourth Five-Year Plan will have more installed capacity in 1950 than before the war. According to the planned rate of utilization, the plant factor will be reduced to a percentage that prevailed in the Soviet electric power industry during 1935 (44.9 percent). This lower rate indicates that a greater stand-by reserve of capacity will be provided for the industry than was available in prewar years. On the other hand, it must not be overlooked that many of the plants were operating under war conditions, and are probably badly in need of repairs.

Extension of existing transmission lines is planned, and new stations are to be built to feed into these lines to increase the available supply of power. The ultimate plan of the Soviet engineers is the interconnecting of transmission systems. Its advantages would be: 1) the increased reliability of power supply; 2) better utilization of stand-by reserves; 3) a lower total load, since individual peaks do not coincide; and 4) increased economy in station operation from the use of units of high efficiency for peak and normal load demands.

Most of the rivers of European Russia are subject to extreme variations in seasonal flow, and reach their maximum volume only during a few months of the year. The Dnepro-GES (112) operates at maximum capacity about 75 days per year. The reported capacity of the first installed unit is 72,000 kw., with two other similar units planned to be placed in operation by the end of 1947. It will probably be some time before this station can be a supporting plant to the transmission system (FIGURE IX-12) to which it is connected. Similar seasonal operating conditions prevail at the Volkhov station (21) which is connected to the Leningrad transmission system. The Svir' II (19) and III (20) are peak-power stations supply-

ing Leningrad by a direct 220-kv. feeder, 290 km. in length. The output of these stations is also governed by the flow of the river Svir', and the total installed capacity of the plants cannot be fully utilized throughout the year (FIGURE IX-10).

(8) Railway electrification

The electrified sections of the railroads in European USSR are found in the suburban areas of Moscow and Leningrad, the portion of the Murmansk line leading south to Kandalaksha, as well as two stretches in the southern railroad system, one from Zaporozh'ye to Dolgintsevo and another from Sinel'nikovo to Zaporozh'ye.

The Murmansk-Kandalaksha Railroad, which is the longest of these lines, receives its power principally from the region's hydroelectric stations. The Tuloma plants (3, 4) power the railroad in the spring and summer. In winter, when the river Tuloma level falls, the Niva II (7) with a relatively unvarying flow, makes up the deficiency in electric power. The transmission lines distributing the power are built to carry 220 and 110 kv. The railroad operates on 3,000 volts d.c. which indicates the use of rotary converters at substations.

Substations are located at Kola, Shonguy, Loparskaya, Taybola, Olen'ya, Monchegorsk, Imandra, Apatity, Pitkul', Zasheyek, and Kandalaksha II (FIGURE IX-9).

In the Leningrad area the following power plants have railroad connections: Regional Plant V 'Krasny Oktyabr' " (30), Regional Plant VI "Slutskaya" (31), "Kirov" (32), "Bol'shevik" (34), H and P (heat and power) plant of the meat combine (37).

Moscow has the largest number of electrified railroads in the Soviet Union. These roads, together with the Moscow underground railroad, can draw power from the large concentration of power plants in the area.

The Dnepro-GES (112) station near the city of Zaporozh'ye supplies power for the electrified railroad lines leading to Sinel'nikovo and to Dolgintsevo.

The short (11 km.) length of electrified track from Kuybyshev to Bezymyankov may receive its power from the large power plant located at Bezymyanka (147).

See Chapter VII (Railroads) for information on electrified lines.

C. Electrical manufacturing

(1) Power machine industry

(a) History and general description.—The power machine building industry of prerevolutionary Russia was almost nonexistent. Practically all of the essential equipment for the electric power industry was imported.

After the Revolution great emphasis was placed on the progress of the industry, and by 1938 machine building occupied a position of particular importance. Since 1928 more than 70% of the power equipment (boilers, turbines, diesels, motors, and electric generators) has been domestically produced and installed. Rapid expansion of the industry took place in the central industrial region (Region VI) and the Ukraine (Region III) during the first and second Five-Year Plans, and as a result of the third Five-Year Plan, machine building was further developed, particularly in the east. With a more even distribution of these plants, the shifting of the industry from the west and south during the recent conflict was made possible by the newly constructed factories in the east. The majority of the power machinery plants were evacuated from the danger zones in 1941 to these newly created centers. Power machinery plants were integrated and placed in the same vicinity in order to make industrial centers as self-sufficient as possible. The evacuated plants were transferred mainly to the following regions: Ural industrial, west Siberia, Turkestan, and the larger cities on the Trans-Siberian Railroad as far east as Irkutskaya Oblast'.

Relocation of the industry started as early as 1942 when most of the Moscow plants were returned to their original sites. Full scale relocation started in 1943, and plants were reconstructed in the west as fast as the Red Army reoccupied cities and regions. Leningrad reestablished some of its former plants and manufactured equipment for the purpose of repairing the destroyed power installations. The new Khar'kov turbogenerator plant has probably become the principal supplier for the restoration of the destroyed industrial installations of the Ukraine and the Donbass. Riga and Tallinn plants now also supply power machinery for the restoration of western European USSR.

The prewar output of power equipment in the USSR is listed according to the types manufactured in TABLE IX-44. The location of the most important power machinery centers in European USSR, with the principal types of equipment produced in each, is shown in TABLE IX-45.

(b) Planned output.—To fulfill the planned increase of 11,700,000 kw. in installed capacity of electric power stations and to complete the replacement of wartime losses, the USSR has set a huge output rate for its production of power generating equipment. By 1950 the production of turbines, for instance, is to total 3,928,000 kw. of installed capacity. It compares with a production rate for similar equipment in 1940 of 1,447,000 kw. In order to achieve this goal, the USSR must not only repair and replace lost manufacturing capacity suffered during the war years but must also increase it by constructing new and larger plants. To this end the current Five-Year Plan calls for the restoration of four power-equipment

TABLE IX - 44

PREWAR MANUFACTURE OF POWER EQUIPMENT IN THE USSR

	Steam boilers	Economizers	Steam turbines	Hydroturbines	A.c. generators	A.c.-d.c. motors	Transformers
	Thousands m^2*	*Thousands* m^2*	*Thousands* *kw.*	*Thousands* *kw.*	*Thousands* *kw.*	*Thousands* *kw.*	*Thousands* *kv.-a.*
1928	87. 9	5. 0	35. 7	12. 0	92. 6	343. 2	403. 2
1930	166. 1	56. 0	24. 1	31. 9	227. 9	807. 2	1, 525. 3
1932	166. 4	55. 5	239. 0	59. 5	1, 164. 3	2, 036. 1	3, 426. 0
1933	200. 3	224. 7	634. 5	52. 9	736. 5	1, 773. 4	3, 330. 0
1934	226. 0	269. 7	363. 8	74. 6	678. 4	1, 871. 9	2, 874. 0
1935	197. 3	281. 4	672. 4	52. 0	732. 5	2, 250. 0	3, 461. 3
1937	170. 4	†	†	86. 7	†	1, 882. 6	2, 743. 0
1942	780. 0	†	†	490. 0	†	4, 800. 0	9, 000. 0

* 1 square meter equals 10.76 square feet.

† Figures not available.

TABLE IX - 45

IMPORTANT POWER MACHINERY MANUFACTURING CENTERS IN EUROPEAN USSR

RSFSR:	
Leningrad	Power plant equipment, spare parts, turbo-hydro-generators (up to 100,000 kw. capacity), electric motors, etc.
Rostov	Steam boilers (largest in USSR).
Saratov	Diesel engines, storage batteries.
Gor'kiy	Transformers rebuilt, diesel engines.
Moscow	Electric locomotives, mobile power stations, transformers, turbines, electrical equipment for iron industry, storage batteries, etc.
Vladimir	Transformers, armatures, etc.
Yaroslavl'	Generators.
Kuybyshev	Steam engines, generators, etc.
Voronezh	Diesel engines.
Ukraine SSR:	
Khar'kov	Turbogenerators (up to 100,000 kw. capacity), large electric motors, shafts for hydro-turbines, etc.
Dnepropetrovsk	Steam boilers.
Kiev	Steam engines and generators.
Bol'shoy Tokmak	Diesel engines.

plants and one boiler factory, and the construction of two hydro-turbine factories, a steam turbine factory, a new generator plant, and three new boiler factories.

There seems little reason to doubt that the output rate of new equipment will rise because of the high order of priority assigned to the industry. However, should the home industry fail to produce the 11,700,000 kw. of new power equipment, the Soviets will still be in a favorable position to attain their goal for new installations. Shortages can be made up by purchases, requisitions, or reparations from foreign countries. Estimates of the amount of such equipment which the Soviet Union has or will receive are not based on complete data, but it is known, nevertheless, that at least 3,300,000 kw. and perhaps as much as 5,500,000 kw. may be expected from such sources by 1950 (TABLE IX-36). Soviet industry, therefore, need only produce from 6,200,000 to 8,400,000 kw. of equipment to fulfill its plan by 1950. Notwithstanding the apparent adequate supply of electric power equipment, the Russians may still face delays because of the lack of experienced construction engineers and skilled workers.

(2) Transmission equipment

All transformers and outdoor switching equipment are manufactured by Soviet plants. The 110-kv. transformers have two and three windings and are made in single and three-phase types. Some of the three-phase transformers in use are rated at 30,000 kv.-a. and have natural cooling. Other three-phase transformer groups consist of single-phase units and have capacity ratings of 60,000 kv.-a. (FIGURE IX-24). The standard practice of Soviet electric power stations is to employ three-phase transformers (except under special conditions) where the required capacity of the transformer unit does not exceed 30,000 kv.-a. For capacities exceeding this limit, assemblies of single-phase units are used.

Soviet plants began to manufacture 220-kv. transformers in 1933. They were rated at 20,000 kv.-a. per phase (group rating 60,000 kv.-a.) for 10.5/220 and 220/110-kv. operation and were placed in service along the Svir'-Leningrad transmission line (FIGURE IX-10). Star-delta, two-winding transformers rated at 40,000 kv.-a. per phase, 220/110 kv. have been manufactured by Soviet plants for the Dnepr-Donets transmission line (FIGURE IX-12).

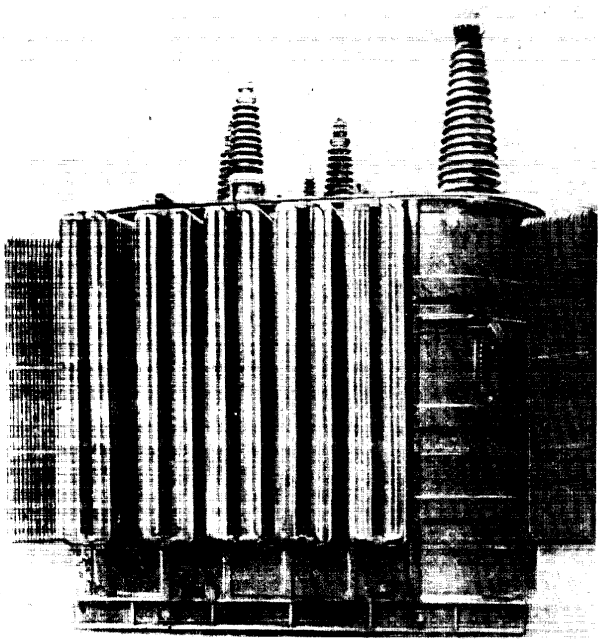


FIGURE IX-24. *Transformer of 20,000 kv.-a. capacity (242/110/10.5 kv.) for the Stalinogorsk-Moscow 220-kv. transmission line, 1936.*

The large H and P (heat and power) stations generally operate their switching at the generator voltage and are connected to the regional network through step-up transformers which have voltage regulators as part of their equipment.

The Scott-Y connection of sectionalizing busbar and stepped-up voltages is most widely used. Current-limiting reactors are employed in the busbar and outgoing feeder circuits to reduce short circuit currents and maintain voltages.

Switching equipment for high voltages (35, 110, and 220 kv.) is usually of the outdoor type. The switching structures are made either of steel or of reinforced concrete, the latter type being widely employed of late. Flexible copper, aluminum, and aluminum steel cables are used for the current-carrying parts with rigid busbars made of tubing also used for 220-kv. substations (FIGURES IX-25 and IX-26).

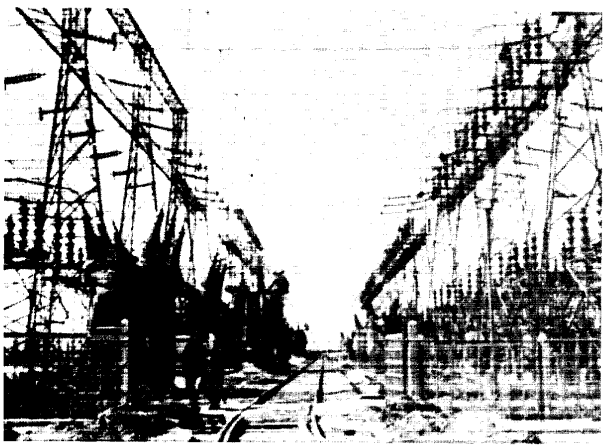


FIGURE IX-25. *Open-air electrical installations at the Dnepro-GES (112), Zaporozh'ye.*
Transformer, cables, high tension lines, and railroad spur above the generator house on the west side of the river. Before 1941.

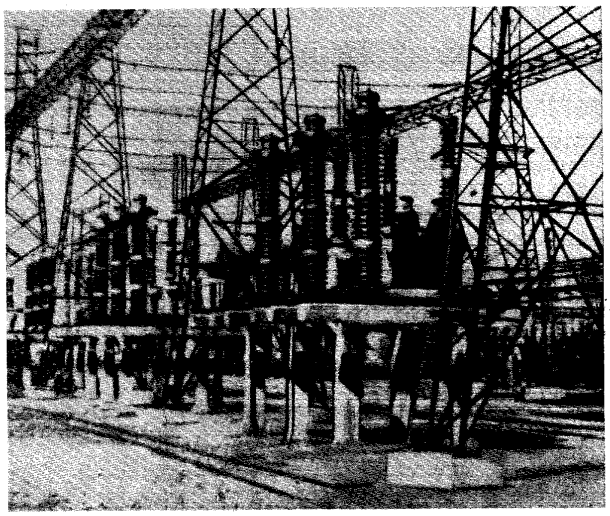


FIGURE IX-26. *Expansion switches (150 kv.) at Nikopol' substation of the Dnepr power system, 1936.*

The oil circuit breakers for 110 and 220-kilovolt outdoor switching structures are made for rupturing capacities up to 2,500,000 kv.-a. (FIGURE IX-27). Switchgear of the metal-clad type has been given consideration, and it is possible that this type has been installed, although available information does not confirm it.

Transmission lines for 35 and 110 kv. are generally supported by wooden poles with the conductors suspended horizontally from wooden cross arms. Metal towers are used for lines operating at 220 kv., with no standard design being in use.

Originally, bare copper wire was used as line conductors, but of late, aluminum steel wire has been widely introduced on the high voltage networks. Some of the short 35-kilovolt distribution lines use stranded steel wire.

Lightning protection has been installed as part of the equipment of transmission lines, but the degree of reliability and efficiency does not measure up to American standards.

Most of the transmission systems employ a directly grounded neutral for voltages of 110 and 220 kv. Soviet engineers have proposed that some systems working at 110 kv. begin operating with an ungrounded neutral and employ suitable arc-suppressing equipment. At the present time some of the transformers in a system have their neutrals directly grounded, while others have the neutrals ungrounded in order to reduce single-phase short circuit currents. An ungrounded neutral is employed in 35-kv. networks, with coils (Peterson) used to compensate capacity currents.

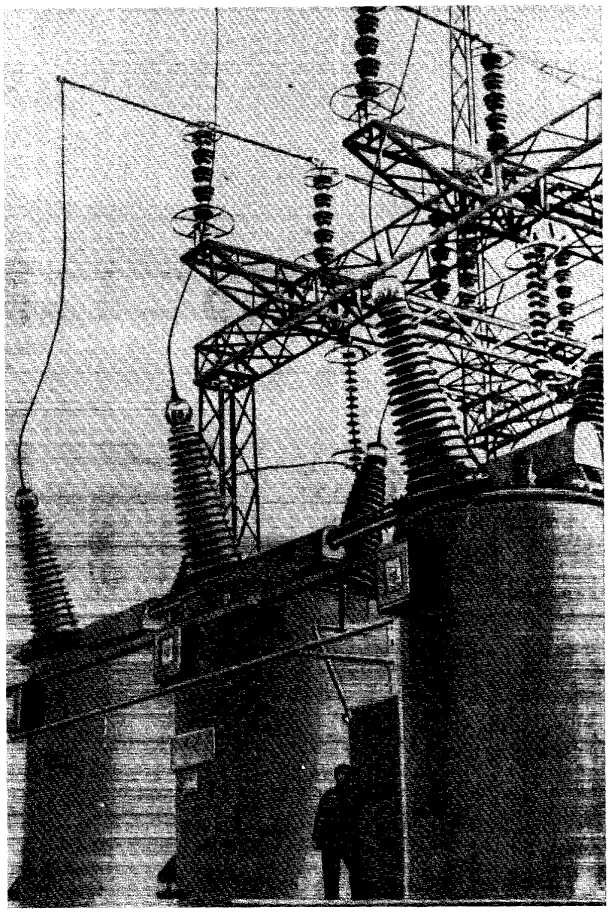


FIGURE IX-27. *Oil switch (800 amp.) for an outdoor substation on the 220-kv. Svir'-Leningrad transmission line, 1936.*

TABLE IX - 46

STATISTICS ON 235 IMPORTANT POWER PLANTS IN EUROPEAN USSR, 1944–1946

(Most of the plant capacities are 10,000 kilowatts or over)

(Current is a.c., 3-phase, 50-cycle unless noted otherwise under remarks)

Plant No. (FIGURE IX-62)	Region, city,* and/or plant name**	Coordinates	Capacity [4]	Type of plant	Fuel	Equipment	Consumers	Remarks
	REGION I—NORTH AND NORTHWEST:	° ′	*Kw.*					
1	Janiskoski (Yaniskoski)[1]*	68 58 N 28 47 E	26,000 (Planned)	Hydro	.....	Unknown	Nickel mines	PRODUCTION: OVER 200,000,000 KW.-HR. (ESTIMATED) Plant is in Petsamo region, Finland. It is leased by Russians for unknown period and is to have 5-meter right-of-way to Russian border. The plant was destroyed during the war, but is to be restored by summer of 1949.
2	Murmansk (H&P)[2]*	68 58 N 33 08 E	36,000	Steam	Coal	4 generating sets	Wood and machine factories.	PRODUCTION: UNKNOWN Connected to Murmashi (3) by transmission line. Two combines, "Zavmorput" and "Glavryb" have small electric plants, but are probably also connected to this network. Within Murmansk there are two small power plants of unknown capacity, one for municipal and the other for industrial purposes. FIGURE IX-9.
3	Lower Tuloma** (Murmashi)*	68 41 N 31 55 E	50,000	Hydro	.....	4 Kaplan turbo-generators.	Murmansk, local industries. Murmansk-Kandalaksha R.R.	PRODUCTION: 223,000,000 KW.-HR. Current supplied to towns: 220 v. Germans claim to have damaged the plant by bombing during the war. FIGURE IX-9, TABLE IX-43.
4	Upper Tuloma** (Verkhnyaya Tulomskaya)**	68 41 N 31 55 E	48,000 (1944)	Hydro	.....	4 turbo-generators	Loparskaya, railroad	PRODUCTION: UNKNOWN Connected to Niva II (7). FIGURE IX-9
5	Kirovsk (H&P)[2]*	67 36 N 33 40 E	36,000	Steam	Coal	Unknown	Iron ore mining, chemicals, apatite and naphthaline production. Murmansk R.R., airport, radio station.	PRODUCTION: UNKNOWN Supplies Murmansk transmission system. FIGURE IX-9
6	Niva I**	67 24 N 32 33 E	60,000 (Planned)	Hydro	.....	Unknown	.....	PRODUCTION: UNKNOWN Only the dam installation erected. FIGURE IX-9
7	Niva II**	67 18 N 32 29 E	66,000	Hydro	.....	4 vertical Francis turbo-generators.	Kirovsk, Murmansk R.R. Saltpeter works in Khibiny, Apatity.	PRODUCTION: 350,000,000 KW.-HR. Distribution: 220 kv. line to Zasheyek, Monchegorsk, Apatity, Imandra, 110 kv. lines to aluminum works at Kandalaksha. FIGURE IX-9, TABLE IX-43

[1] Plant located in occupied area, or known to have been destroyed or evacuated during the war.

[2] H&P: Power plant producing heat and power. This is the translation of the Russian word TETs.

[4] These capacities are as reported, estimated, or the average of reported capacities.

* Name of city. ** Name of plant.

TABLE IX - 46 (Continued)

Plant No. (FIGURE IX-62)	Region, city,* and/or plant name**	Coordinates	Capacity [4]	Type of plant	Fuel	Equipment	Consumers	Remarks
	REGION I: (*continued*)	° ′	*Kw.*					
8	Niva III**	67 10 N 32 28 E	120, 000 (Planned)	Hydro	.....	4 turbo-generators	Murmansk-Kandalaksha R.R. Murmansk transmission system.	PRODUCTION: 750,000,000 KW.-HR. (PLANNED) Station is constructed 200 ft. underground, probably for protection against freezing. Begun 1936. Planned operation 1942. Machinery evacuated to Ust'-Kamenogorsk, then to "Irtysh-GES" (Siberia) FIGURE IX-9
9–10	Kondopoga:*	62 11 N 34 22 E						
9	Hydroelectric Plant[1]**	.....	26, 000	Hydro	.....	6—5,700 hp. horizontal turbo-generators (prewar).	Paper combine, Petrozavodsk and vicinity	PRODUCTION: 100,000,000 KW.-HR. (1938) One turbine restored. Second turbine to have been commissioned late in 1947.
10	Power Plant[1]**	.....	7, 000	Steam	Unknown	Unknown	Paper combine	PRODUCTION: UNKNOWN
11	Solomennoye*	61 51 N 34 24 E	10, 000	Steam	Wood	Unknown	Industry, town	PRODUCTION: UNKNOWN Connected with Kondopoga hydroelectric station (9).
12	Molotovsk*	64 34 N 39 51 E	50, 000	Steam	Mixed	4 turbines, 4 boilers	Shipyard, city, etc.	PRODUCTION: UNKNOWN Belongs to shipyard but supplies other industries and city.
13	Arkhangel'sk (H&P)[1,2]*	64 33 N 40 32 E	12, 000	Steam	Mixed (wood)	2 turbines, 6,000 kw	Industry, town	PRODUCTION: UNKNOWN Destroyed by bombing, September 1942.
14	Kotlas*	61 12 N 46 50 E	68, 000 (Planned)	Steam	Probably oil	Unknown	Shipyards, armament factory, paper and lumber mills, etc.	PRODUCTION: 273,000,000 KW.-HR. The planned amounts were reported in 1934. Located on left bank of the Vychegda River. Products: 2,800 hp. tugs, medium and light cutters, passenger steamers; tugs; repair of river boats; 500 kg. bombs; 122 and 203 mm. artillery shells.
15	Ukhta*	63 34 N 53 40 E	30, 000	Steam	Oil	Unknown	Industrial works and settlements.	PRODUCTION: UNKNOWN
16	Ust'-Usa*	65 57 N 56 55 E	5, 000	Steam	Mixed	Unknown	Industry, town	PRODUCTION: UNKNOWN
17	Vorkuta*	67 30 N 64 00 E	10, 000	Steam	Coal	Unknown	Mines, town, railroad	PRODUCTION: UNKNOWN
18	Syktyvkar*	60 50 N 50 26 E	2, 000	Steam	Mixed	Unknown	Industry, town	PRODUCTION: UNKNOWN Reported capacity from 1,000 to 3,000 kw.
19	Svir' II (Upper)**	60 55 N 34 03 E	180, 000 (Planned)	Hydro	.....	4—37,500 hp. vertical Kaplan turbo-generators.	Leningrad transmission system.	PRODUCTION: 623,000,000 KW.-HR. (PLANNED) Construction resumed (1946). At outbreak of war equipment had been evacuated to Molotov. Will be connected to Leningrad by 220 kv. line. FIGURE IX-10

20	Svir' III (Lower)[1]**	60 48 N 33 43 E	96, 000	Hydro.	.....	4 Kaplan turbo-generators and 3 auxiliary units.	Leningrad transmission system.	PRODUCTION: 540,000,000 KW.-HR. Reported restoration: First turbine in operation, March 1946. Second in October 1946. Each turbine capacity 24,000 kw. 220 kv. overhead transmission line to Leningrad. FIGURE IX-10, TABLE IX-43
21	Volkhov[1]**	59 55 N 32 21 E	66, 000	Hydro.	.....	8—11,500 hp. (8,750 kv.-a.) vertical Francis turbo-generators.	Leningrad transmission system aluminum plant.	PRODUCTION: 350,000,000 KW.-HR. Station restored to original capacity in 1944. Connected to Leningrad by 110 kv. line via transformer station at Naziya. Reported to be a peak load station. FIGURE IX-10, TABLE IX-43
22	Hydroelectric project**	59 50 N 32 20 E	50, 000 (Planned)	Hydro.	.....	Kaplan turbo-generators planned.	Leningrad transmission system.	PRODUCTION: UNKNOWN Site of plant is to be south of Volkhov on the Volkhov R. FIGURE IX-10
23	Dubrovka[1]**	59 53 N 30 56 E	200, 000	Steam.	Peat.	4 turbines, 50,000 kw. each.	do.	PRODUCTION: UNKNOWN Reconstruction completed. Connected with Leningrad by 110 kv. transmission lines via transformer station at Naziya. FIGURE IX-10
24	Raukhialu[1] (Rouhiala)**	63 03 N 28 55 E	96, 000	Hydro.	.....	4—24,000 kw. turbo-generators.	do.	PRODUCTION: UNKNOWN 160 km. transmission line to Leningrad. Probably 110 kv. FIGURE IX-10
25	Enso[1]*	61 07 N 28 52 E	50, 000 (1946)	Hydro.	.....	2—25,000 kw. turbo-generators.	do.	PRODUCTION: UNKNOWN Third turbine installation reported. Would raise capacity to 75,000 kw. Coupled with Raukhialu (24). FIGURE IX-10
26–39	Leningrad:*	59 55 N 30 20 E						PRODUCTION: UNKNOWN Leningrad transmission system, 1944 (FIGURE IX-10).
26	Regional I (H&P)[2]**	.....	114, 000	Steam.	Coal, mazut.	5—15,000 kw. turbines, 1—30,000 kw. turbine.	do.	PRODUCTION: UNKNOWN Equipment includes 24 boilers operating at approximately 240 lbs. per sq. in. steam pressure. 110 kv. overhead transmission line to "South" transformer station.
27	Regional II (H&P)[2]**	.....	70, 000	Steam.	Coal.	Unknown.	do.	PRODUCTION: UNKNOWN Located in 35 kv. net.
28	Regional III (H&P)[2]**	.....	9, 500	Steam.	Coal, mazut.	Unknown.	do.	PRODUCTION: UNKNOWN Located in 35 kv. net. Reported capacity from 6,000 to 13,000 kw.
29	Regional IV (H&P)[2]**	.....	60, 000	Steam.	Coal, peat, mazut.	Unknown.	do.	PRODUCTION: UNKNOWN Located in 35 kv. net.

[1] Plant located in occupied area, or known to have been destroyed or evacuated during the war.
[2] H&P: Power plant producing heat and power. This is the translation of the Russian word TETs.
[4] These capacities are as reported, estimated, or the average of reported capacities.
* Name of city. ** Name of plant.

TABLE IX - 46 (Continued)

Plant No. (FIGURE IX-62)	Region, city,* and/or plant name**	Coordinates	Capacity [4]	Type of plant	Fuel	Equipment	Consumers	Remarks
	REGION I: (*continued*)	° ′	*Kw.*					
30	Regional V "Krasny Oktyabr' "**.	.....	110, 000	Steam.	Peat.	2—45,000 kw. turbines; 3 boilers.	do.	PRODUCTION: UNKNOWN Located in 35 kv. net. 110 kv. lines to Dubrovka (23) and double transmission line to Svir' III (20). R.R. connection.
31	Regional VI "Slutskaya"**	.....	4, 000	Steam.	Coal.	Unknown.	do.	PRODUCTION: UNKNOWN Located in 35 kv. net. R.R. connection.
32	"Kirov"**	.....	120, 000	Steam.	Bituminous shale, oil, coal dust.	Unknown.	do.	PRODUCTION: UNKNOWN Located in 35 kv. net. 110 kv. line connection to "West" transformer station. R.R. connection.
33	"Stalin" (turbine plant)[1]**	.....	12, 000	Steam.	Coal.	Unknown.	do.	PRODUCTION: UNKNOWN
34	"Bol'shevik"**	.....	84, 000	Steam.	Coal, mazut.	Unknown.	do.	PRODUCTION: UNKNOWN Located in 35 kv. net. R.R. connection.
35	Vasil'yevskiy Ostrov (new)**	.....	Probably 48, 000	Steam.	Coal.	Unknown.	do.	PRODUCTION: UNKNOWN Located in 35 kv. net.
36	Vasil'yevskiy Ostrov (old)	.....	7, 500	Steam.	Coal.	Unknown.	do.	PRODUCTION: UNKNOWN Located in 35 kv. net by underwater cable to south bank of the Neva.
37	H&P[2] (meat combine)	.....	25, 000	Steam.	Coal.	2 boilers. 3rd planned (1941).	do.	PRODUCTION: UNKNOWN Supplied 10 million kw.-hr. to municipal net in 1941. Located in 35 kv. net. R.R. connection.
38	"Treugol'nik"	.....	10, 000	Steam.	Coal.	Unknown.	do.	PRODUCTION: UNKNOWN Located in 35 kv. net. Reported capacity from 8,000 to 12,000 kw.
39	H&P[2]**	.....	9, 000	Steam.	Coal.	Unknown.	Industry.	PRODUCTION: UNKNOWN In operation August 1943. Located at "Nevskiy" machine construction works. Reported capacity from 6,000 to 12,000 kw.
40	Tikhvin*	59 38 N 33 31 E	12, 000	Steam.	Probably peat.	1 turbo-generator, 12,000 kw.	Bauxite plant	PRODUCTION: UNKNOWN Peat-fired plant with capacity of 6,000 kw. also reported for town at the clay processing factory.
41	Kolpino*	59 45 N 30 35 E	24, 000	Steam.	Probably peat.	2 generating sets, 12,000 kw. each.	Industry, town.	PRODUCTION: UNKNOWN Located at the Izhora plant.
42	Borovichi*	58 23 N 33 56 E	7, 000	Diesel, steam.	Mixed, peat.	6 diesels, 6 generators, 2 turbines.	Local industries.	PRODUCTION: UNKNOWN City power requirements supplied by wood-fired plant at Okulovka with a capacity of 6,600 kw.

Approved For Release 2003/05/14 : CIA-RDP79-01144A000200010009-0

43	Cherepovets*	59 09 N 37 55 E	30,000 (1947)	Steam.	Peat.	2 turbo-generators, 15,000 kw. each.	Canal system.	PRODUCTION: UNKNOWN Under construction since 1941. Intended operation by 1942. To power recently constructed sluices of old canal system. Reported 30,000 kw. capacity may already be installed (1947).
44	Kadnikov*	59 30 N 40 20 E	17,500	Probably steam.	Unknown.	Unknown.	Industry, town.	PRODUCTION: UNKNOWN Reported capacity from 10,000 to 25,000 kw.
45	Sokol (H&P)[2]*	59 28 N 40 10 E	15,000	Steam.	Wood, mixed.	4 turbo-generators, 3 boilers.	Paper and cellulose combines. Other factories and city.	PRODUCTION: UNKNOWN Turbines at following capacities: 2,600 kw., 3,000 kw., 4,000 kw., 6,000 kw.
46	Vologda (H&P)[2]*	59 17 N 39 51 E	12,000	Steam.	Oil, wood.	1—12,000 kw. unit.	Industry, town.	PRODUCTION: UNKNOWN Built 1937–41. Old power plant still in existence. Capacity to be increased to 18,000 kw.
	REGION II—WEST:							
	ESTONIAN SSR:							
47	Tallinn[1]*	59 27 N 24 45 E	20,000	Steam.	Oil shale, coal.	Unknown.	Industry, city.	PRODUCTION: UNKNOWN Distribution voltage: 220/380. Lacks modern technical equipment. Machinery from Berlin-Drattendorf arrived December 1946, still being installed in January 1947. Under combined Soviet-Estonian management.
48	Jägala[1]*	58 25 N 25 14 E	1,250	Probably steam.	Unknown.	Unknown.	Industry, city.	PRODUCTION: UNKNOWN Distribution voltage: 220.
49	Kunda[1]*	59 31 N 26 31 E	2,500	Steam.	Unknown.	Unknown.	Industry, town.	PRODUCTION: UNKNOWN Distribution voltage: 220/380, a.c., 1,250 kw. Distribution voltage: 110/600, d.c., 1,250 kw.
50	Püssi[1]*	59 23 N 27 04 E	3,740	Steam.	Unknown.	Unknown.	Shale industry.	PRODUCTION: UNKNOWN Distribution voltage: 220/380. Reported restored (November 1946).[1] Total capacity raised by Germans to 9,740 kw.
51–52	Narva:*	59 22 N 28 10 E						
51	Virumaa Elect. Co.[1]**	.....	5,000	Steam.	Unknown.	Unknown.	Industry, city.	PRODUCTION: UNKNOWN Distribution voltage: 220/380.
52	Kreenholm Cotton Mills[1]**	.....	3,520	Hydro.	....	Unknown.	Cotton mills.	PRODUCTION: UNKNOWN Distribution voltage: 220/380. Destroyed during war. Huge hydro plant planned (February 1947).
53	Ellamaa[1]*	59 03 N 24 09 E	8,000	Steam.	Unknown.	Unknown.	Industry, town.	PRODUCTION: UNKNOWN Distribution voltage: 220/380.
54	Prnäu[1]*	58 23 N 24 28 E	1,500	Probably steam.	Unknown.	Unknown.	Industry, town.	PRODUCTION: UNKNOWN Distribution voltage: 220 d.c.
55	Sindi[1]*	58 23 N 24 38 E	1,500	Probably steam.	Unknown.	Unknown.	Industry, town.	PRODUCTION: UNKNOWN Distribution voltage: 220/380.

[1] Plant located in occupied area, or known to have been destroyed or evacuated during the war.
[2] H&P: Power plant producing heat and power. This is the translation of the Russian word TETs.
[4] These capacities are as reported, estimated, or the average of reported capacities.
* Name of city. ** Name of plant.

Confidential

TABLE IX - 46 (Continued)

Plant No. (FIGURE IX-62)	Region, city,* and/or plant name**	Coordinates	Capacity [4]	Type of plant	Fuel	Equipment	Consumers	Remarks
	REGION II: (*continued*)	° ′	*Kw.*					
56	Ulila[1]*	58 22 N 26 25 E	5,000	Steam.	Unknown.	Unknown.	Industry, town.	PRODUCTION: UNKNOWN Distribution voltage: 220/380. Capacity raised by Germans to 6,500 kw.
	LATVIAN SSR:							
57	Rīga[1]*	56 57 N 24 05 E	20,000	Steam.	Coal.	Unknown.	Municipal area.	PRODUCTION: 88,300,000 KW.-HR. (1937) Distribution voltage: 120/220/380. Power received from Kegums.
58	Kegums[1]*	56 45 N 24 40 E	51,000	Hydro.	....	3 vertical turbo-generators 17,000 kw. each.	Industry, Rīga.	PRODUCTION: 270,000,000 KW.-HR. Distribution voltage: 220/380. Second turbine in operation May 1946; third to be installed. Plan increase to several times prewar capacity. Generators by "Electrosila", Leningrad. Head at dam: 16 m. Lines to Rīga, Jelgava, Bauska, Jeriki, Daugavpils, Saldus, Talsi, Valmiera.
59	Jelgava[1] (Mitau)*	56 38 N 23 40 E	1,625	Steam.	Unknown.	4 steam turbines, 2 boilers.	Local area.	PRODUCTION: UNKNOWN Distribution voltage: 220/380.
60	Liepāja[1]*	56 31 N 21 00 E	13,000	Steam.	Coal.	Unknown.	Industry, town.	PRODUCTION: UNKNOWN Distribution voltage: 220/380. Germans raised capacity to 18,000 kw. A 5,000-kw. turbine evacuated by Germans in 1944.
	LITHUANIAN SSR:							
61	Klaipėda[1] (Memel)*	55 42 N 21 10 E	4,500	Steam.	Unknown.	2 turbines: 1,500 kw. and 3,000 kw.	Industry, town.	PRODUCTION: UNKNOWN Distribution voltage: 220/380. 66 km. low tension lines. Large power plant under construction (July 1946).
62	Šiauliai[1]*	55 56 N 23 20 E	2,020	Steam.	Unknown.	Unknown.	Industry, town.	PRODUCTION: UNKNOWN Distribution voltage: 220/380. 3 transformer stations in city. Another plant of unknown capacity reported operating.
63	Bačiunai[1]*	55 55 N 23 45 E	1,750	Steam.	Peat.	2 boilers; 2 turbo-generators: 1,000 kw. and 750 kw. each.	Šiauliai and Radviliškis.	PRODUCTION: UNKNOWN
64	Rekyvos[1]**	55 52 N 23 20 E	5,000	Steam.	Peat.	1—2,500 kw. turbine.	Šialiai, Radviliškis, Šeduva.	PRODUCTION: UNKNOWN
65	Linkaičiai[1]*	55 45 N 23 37 E	1,600	Steam.	Peat.	Unknown.	Munitions factory.	PRODUCTION: UNKNOWN
66	Panevėžys*	55 44 N 24 22 E	1,616	Probably steam.	Unknown.	Unknown.	Industry, town.	PRODUCTION: UNKNOWN Distribution voltage: 220/380.

67	Kedainiai[1]	55 17 N 23 59 E	1,000	Diesel.	Oil.	Unkn wn.	Industry, town.	PRODUCTION: UNKNOWN Distribution voltage: 220/440 d.c.
68–69	Kaunas (Kovno):*	54 54 N 23 55 E						
68	Petrašiunai Regional Plant[1]**	.....	10,000	Steam.	Peat, coal.	2 turbo-generator .	Industry, city.	PRODUCTION: UNKNOWN Distribution voltage: 220/380. Increase to 24,000 kw. planned (1939). Large power plant und r construct on (July 1943 .
69	Municipal Plant[1]**	.....	1,598	Diesel.	Oil.	Unknown.	Industry, city.	PRODUCTION: UNKNOWN Di tribution voltage: 220/380 a.c. Distribution voltage: 110/220 d.c.
70	Vil'nyus[1]*	54 41 N 25 16 E	4,800	Probably steam.	Unknown.	Unknown.	Industry, city.	PRODUCTION: UNKNOWN Transmission voltage: 500/6,300. Second power plant under construction on Neris River; to have started operations August 1946 (July 1946). Two smaller plants of unknown capacity reported operating within the city.
71	Puskelniai[1]*	54 37 N 23 24 E	Unknown.	Hydro.	....	Unknown.	Local area.	PRODUCTION: UNKNOWN No data—under construction in 1938. Connected to Mariampulė hydro station (250 kw.).
	KALININGRADSKAYA OBLAST', RSFSR:							
72–73	Kaliningrad (Königsberg):*	54 45 N 20 31 E						
72	Municipal[1]**	.....	20,250	Steam.	Hard coal.	Unknown.	City.	PRODUCTION: UNKNOWN Distribution voltage: 220.
73	Regional[1]**	.....	29,000	Steam.	Coal.	Unknown.	Industry, city.	PRODUCTION: UNKNOWN. Distribution voltage: 220/380. 60 kv. grid runs to Danzig, Elblag (Poland), Klaipėda (61), Gross-Vonsdorf (75), Pravdinsk (76), Sovetsk (Tilsit).
74	Gusev[1] (Gumbinnen)*	54 35 N 22 12 E	11,000	Steam.	Coal.	Unknown.	Industry, town.	PRODUCTION: UNKNOWN
75	Gross Vonsdorf[1]*	54 30 N 21 08 E	3,120	Hydro.	....	4 vertical Francis turbines 1,040 hp. each. 2—1,850 kv.-a. generators.	Industry, Kaliningrad.	PRODUCTION: UNKNOWN
76	Pravdinsk[1]*	54 27 N 21 02 E	10,000	Hydro.	....	4 horizontal Francis twin turbines, 3 of 5,400 hp., 1 of 2,100 hp. Direct coupled generators.	Industry, Kaliningrad, Elblag (Poland).	PRODUCTION: UNKNOWN Transmission lines: 6,000 v. to transformer station, 15,000 v. regional, 60,000 v. long distance. Lines to Gross Vonsdorg (75), Kaliningrad (72 and 73) and Elblag (Poland).
	WHITE RUSSIAN SSR:							
77	Molodechno[1]*	54 18 N 26 50 E	15,000	Steam.	Peat or oil.	Unknown.	Industry, town.	PRODUCTION: UNKNOWN Capacity reported from from 5,000 to 25,000 kw.
78	Grodno[1]*	53 40 N 23 50 E	3,075	Steam.	Unknown.	Unknown.	do.	PRODUCTION: UNKNOWN Distribution voltage: 250/6,600.

[1] Plant located in occupied area, or known to have been destroyed or evacuated during the war.
[4] These capacities are as reported, estimated, or the average of reported capacities.
* Name of city. ** Name of plant.

TABLE IX - 46 (Continued)

Plant No. (FIGURE IX-62)	Region, city,* and/or plant name**	Coordinates	Capacity [1]	Type of plant	Fuel	Equipment	Consumers	Remarks
		° ′	*Kw.*					
	REGION II: (*continued*)							
79	Volkovysk[1]* "Podros"**	53 10 N 24 28 E	1, 306	Steam.	Unknown.	Unknown.	do.	PRODUCTION: UNKNOWN
80	Brest[1]*	52 06 N 23 41 E	15, 000	Steam.	Peat or oil.	Unknown.	do.	PRODUCTION: UNKNOWN Reported capacity from 5,000 to 25,000 kw.
81	Nesvizh[1]*	53 13 N 26 40 E	15, 000	Steam.	Peat or oil.	Unknown.	do.	PRODUCTION: UNKNOWN Reported capacity from 5,000 to 25,000 kw.
82	Borisov[1]*	54 17 N 28 30 E	3, 000	Steam.	Mixed.	Unknown.	do.	PRODUCTION: UNKNOWN Reported capacity from 1,000 to 5,000 kw.
83	Minsk[1]*	53 54 N 27 34 E	15, 000	Steam.	Peat or oil.	Unknown.	do.	PRODUCTION: UNKNOWN Reported fully restored (August 1947). Reported capacity from 5,000 to 25,000 kw.
84	Bobruysk[1]*	53 10 N 29 12 E	15, 000	Steam.	Peat or oil.	Unknown.	do.	PRODUCTION: UNKNOWN Reported capacity from 5,000 to 25,000 kw.
85	Osinovka[1]* "Bel-GRES"**	54 39 N 30 40 E	20, 000	Steam.	Peat.	Unknown.	Orsha, peat industry	PRODUCTION: UNKNOWN Largest plant in White Russian SSR. Transmission lines to Orsha Mogilëv (86), Vitebsk, Shklov, Baran' Kopys' Dubrovno. In operation June 1946.
86	Mogilëv[1]*	53 55 N 30 18 E	15, 000	Steam.	Mixed.	Unknown.	Industry, town.	PRODUCTION: UNKNOWN Reported capacity from 5,000 to 25,000 kw.
87	Krichev[1]*	53 40 N 31 40 E	3, 000	Steam.	Mixed.	Unknown.	do.	PRODUCTION: UNKNOWN Reported capacity from 1,000 to, 5,000 kw.
88	Rechitsa[1]*	52 22 N 30 22 E	3, 000	Steam.	Mixed.	Unknown.	do.	PRODUCTION: UNKNOWN Reported capacity from 1,000 to 5,000 kw.
89–90	Gomel':*	52 25 N 31 00 E						
89	Plant I**	.....	15, 000	Steam.	Mixed.	Unknown.	Industry, town.	PRODUCTION: UNKNOWN Reported capacity from 5,000 to 25,000 kw.
90	Plant II**	.....	3, 000	Steam.	Mixed.	Unknown.	do.	PRODUCTION: UNKNOWN Reported capacity from 1,000 to 5,000 kw.
	REGION III—SOUTH (UKRAINE):							
91	L'vov[1]*	49 56 N 24 02 E	25, 900	Unknown.	Unknown.	Unknown.	City.	PRODUCTION: UNKNOWN Soviet sources state L'vov electric power plants now restored (1946). Power reported to be 18% over prewar.

92	Borislav[1]*	49 15 N 23 30 E	11, 200	Unknown.	Unknown.	Unknown.	6 towns, possibly including Drogobych (93).	PRODUCTION: UNKNOWN
93	Drogobych[1]*	49 22 N 23 31 E	4, 700	Unknown.	Unknown.	Unknown.	Industry, town.	PRODUCTION: UNKNOWN Line voltage: 550 and 5,400 v.
94	Chernovtsy[1]*	48 17 N 25 57 E	6, 820	Steam and diesel.	Oil (all or part).	Unknown.	do.	PRODUCTION: 15,400,000 KW.-HR. (1939) Steam plant: 6,624 hp., diesel: 2,250 hp Distribution voltage: 110/190.
95–97	Kiev:*	50 26 N 30 31 E						
95	Municipal Plant[1]**	.....	40, 000	Probably steam.	Unknown.	Unknown.	City.	PRODUCTION: UNKNOWN
96	H & P[1,2]**	.....	80, 000	Probably steam.	Unknown.	Unknown.	Factories and public buildings, R.R.	PRODUCTION: UNKNOWN Heat and power plant for southwest railway administration.
97	Regional Plant[1]**	.....	25, 000	Probably steam.	Unknown.	Unknown.	Industry, city.	PRODUCTION: UNKNOWN
98–99	Odessa:*	46 28 N 30 45 E						
98	Plant I[1]**	.....	42, 500	Probably steam.	Unknown.	Unknown.	do.	PRODUCTION: UNKNOWN. Probably a.c. Prewar capacity from 35,000 to 50,000 kw. Restored capacity in 1944 was 500 kw.
99	Plant II[1]**	.....	Unknown	Steam.	Unknown.	Unknown.	do.	PRODUCTION: UNKNOWN This plant and possibly a third is reported for Odessa. Each plant is believed to be of large capacity, with regional lines.
100	Poltava[1]**	49 36 N 34 35 E	10, 000	Steam.	Unknown.	Unknown.	do.	PRODUCTION: UNKNOWN Another small plant of 3,000 kw. reported located in the city.
101	Kremenchug[1]*	49 05 N 33 30 E	600, 000 (Planned)	Hydro.	....	Unknown.	Dnepr-Donets net.	PRODUCTION: 1,500,000,000 KW.-HR. (PLANNED). Under construction. Surveying under way. Will equalize water supply for Dnepro-GES (112). FIGURE IX-12.
102–103	Nikolayev:*	46 58 N 32 00 E						
102	Old Town Plant[1]**	.....	12, 000	Steam.	Unknown.	Unknown.	City.	PRODUCTION: UNKNOWN FIGURE IX-12.
103	New Town Plant[1]**	.....	25, 000	Steam.	Unknown.	Unknown.	City.	PRODUCTION: UNKNOWN FIGURE IX-12.

[1] Plant located in occupied area, or known to have been destroyed or evacuated during the war.
[2] H&P: Power plant producing heat and power. This is the translation of the Russian word TETs.
[4] These capacities are as reported, estimated, or the average of reported capacities.
* Name of city. ** Name of plant.

TABLE IX-46 (Continued)

Plant No. (FIGURE IX-62)	Region, city,* and/or plant name**	Coordinates	Capacity [4]	Type of plant	Fuel	Equipment	Consumers	Remarks
	REGION III: (*continued*)	° ′	*Kw.*					
104–106	Khar'kov:*	49 59 N 36 17 E						
104	Plant I[1]**		26,000	Steam.	Unknown.	Unknown.	Industry, city.	PRODUCTION: UNKNOWN All Khar'kov power stations interconnected. FIGURE IX-12.
105	Plant II[1]**	.....	53,000	Steam.	Unknown.	Unknown.	do.	PRODUCTION: UNKNOWN All Khar'kov power stations interconnected. FIGURE IX-12.
106	Plant III[1]**	.....	40,000	Steam.	Unknown.	Unknown.	do.	PRODUCTION: UNKNOWN All Khar'kov power stations interconnected. FIGURE IX-12.
107	Chuguyev[1]*	59 50 N 36 43 E	48,000	Steam.	Unknown.	Unknown.	Industry, town Khar'kov.	PRODUCTION: UNKNOWN Connected to Khar'kov power system. FIGURE IX-12.
108	Dneprodzerzhinsk[1]* (Kamenskoye Regional Station)**	48 30 N 34 32 E	198,000	Steam.	Unknown.	Unknown.	District.	PRODUCTION: UNKNOWN Plant is used to supplement power of Dnepro-GES. FIGURE IX-12.
109	Dnepropetrovsk[1]* "Petrovsk"**	48 27 N 35 03 E	30,000	Steam.	Unknown.	Unknown.	Iron works.	PRODUCTION: UNKNOWN FIGURE IX-12.
110–111	Krivoy Rog:*	47 55 N 33 20 E						
110	Regional Plant[1]**	.....	44,000	Steam.	Unknown.	Unknown.	District.	PRODUCTION: UNKNOWN "Krivoy Rog station" reported operating at capacity (1946). FIGURE IX-12.
111	Factory Plant[1] (iron works)**	.....	50,000	Steam.	Unknown.	Unknown.	Iron works.	PRODUCTION: UNKNOWN FIGURE IX-12.
112	Dnepro-GES[1,3]**	47 52 N 35 05 E	72,000 (1947) 585,000 (Planned)	Hydro.	....	9 turbo-generators, 90,000 kv.-a. each.	Metallurgical plants, Dnepr-Donets net.	PRODUCTION: 3,000,000,000 KW.-HR. (PLANNED) Entire plant destroyed by Germans. Prewar capacity was 558,000 kw. Planned reconstruction to raise capacity to 585,000 kw. Postwar generators rated at 90,000 kv.-a. each. One generator has been installed (March 1947). Second generator installation, scheduled for October 1947 and third before the end of the year. The initial three units are of American manufacture. Six remaining units are to be built by the Soviets. TABLE IX-43.
113	Zaporozh'ye[1]* (Zaporozhstal')**	47 48 N 35 11 E	25,000	Steam.	Unknown.	Unknown.	Steel combine, Dnepr-Donets net.	PRODUCTION: UNKNOWN 25,000 kw. generator for this station being rebuilt. FIGURE IX-12.

114	Kerch[1]*	45 21 N 36 25 E	10, 000	Steam.	Unknown.	Unknown.	Industry.	PRODUCTION: UNKNOWN Capacity in doubt. May be as much as 25,000 kw.
115	Sevdon-GRES[1] (Regional)**	48 53 N 38 28 E	65, 000	Steam.	Unknown.	Unknown.	District, Dnepr-Donets net.	PRODUCTION: UNKNOWN Turbines were being overhauled and 2 boilers out of 5 restored in October 1946. FIGURE IX-12.
116	Kadiyevka[1]*	48 33 N 38 42 E	12, 000	Steam.	Unknown.	Unknown.	Town, Dnepr-Donets net.	PRODUCTION: UNKNOWN FIGURE IX-12.
117	Voroshilovgrad[1]*	48 35 N 39 18 E	25, 000	Steam.	Unknown.	Unknown.	Armament plant, Dnepr-Donets net.	PRODUCTION: UNKNOWN In operation by Russians, February 1944. It may be presumed that this station is completely restored. FIGURE IX-12.
118	Voroshilovsk[1]*	48 30 N 38 48 E	24, 000	Steam.	Unknown.	Unknown.	Iron works, Dnepr-Donets net.	PRODUCTION: UNKNOWN FIGURE IX-12.
119	Shter-GRES (Regional)[1]**	48 05 N 38 55 E	152, 000	Steam.	Unknown.	Unknown.	District. Dnepr-Donets net.	PRODUCTION: UNKNOWN Two out of three turbines overhauled (October 1946). FIGURE IX-12.
120–122	Kramatorsk:*	48 42 N 37 32 E						
120	H & P[1,2]**	.....	25, 000	Steam.	Unknown.	Unknown.	Machine factory, Dnepr-Donets net.	PRODUCTION: UNKNOWN FIGURE IX-12.
121	H & P[1,2]**	.....	25, 000	Steam.	Unknown.	Unknown.	Armament plant, Dnepr-Donets net.	PRODUCTION: UNKNOWN FIGURE IX-12.
122	H & P[1,2]**	.....	12, 000	Steam.	Unknown.	Unknown.	Town, Dnepr-Donets net.	PRODUCTION: UNKNOWN Partly in operation (1944). Probably now completely restored. FIGURE IX-12.
123	Gorlovka[1]*	48 20 N 38 04 E	12, 000	Steam.	Unknown.	Unknown.	Town, Dnepr-Donets net.	PRODUCTION: UNKNOWN FIGURE IX-12.
124	Zuyevka[1]** (Zu-GRES)** (Regional).	48 03 N 38 10 E	350, 000	Steam.	Unknown.	Unknown.	Coal and metallurgical industries, Dnepr-Donets net. District.	PRODUCTION: UNKNOWN Restored completely August 1946. Most important steam plant of the Ukraine. FIGURE IX-12.
125	Konstantinovka[1]*	48 32 N 37 42 E	27, 000	Steam.	Unknown.	Unknown.	Iron works, Dnepr-Donets net.	PRODUCTION: UNKNOWN FIGURE IX-12.
126	Kurakhovka[1] (Regional)*	48 04 N 37 25 E	100, 000	Steam.	Unknown.	Probably 2—50,000 kw. turbines.	District, Dnepr-Donets net.	PRODUCTION: UNKNOWN 50,000 kw. turbine went into operation October 1946. Station probably completely restored. FIGURE IX-12.

[1] Plant located in occupied area, or known to have been destroyed or evacuated during the war.
[2] H&P: Power plant producing heat and power. This is the translation of the Russian word TETs.
[3] GES: Hydroelectric station. Frequently used as a suffix to indicate the plant type, e.g., Dnepro-GES. However, note that stations belonging to the Moscow power system are "Mo-GES I, Mo-GES II", etc., and are thermal stations.
[4] These capacities are as reported, estimated, or the average of reported capacities.
* Name of city.
** Name of plant.

TABLE IX - 46 (Continued)

Plant No. (FIGURE IX-62)	Region, city,* and/or plant name**	Coordinates	Capacity [4]	Type of plant	Fuel	Equipment	Consumers	Remarks
		° ′	*Kw.*					
	REGION III: (*continued*)							
127	Makeyevka* "Makzavod"[1]**	48 02 N 37 58 E	47, 000	Steam.	Unknown.	Unknown.	Iron works, Dnepr-Donets net.	PRODUCTION: UNKNOWN FIGURE IX-12.
128	Stalino[1]*	47 58 N 37 48 E	22, 000	Steam.	Unknown.	Unknown.	Iron works, Dnepr-Donets net.	PRODUCTION: UNKNOWN In operation December 1943. Probably now completely restored. FIGURE IX-12.
129	Rutchenkovo[1]*	47 56 N 37 42 E	12, 000	Steam.	Unknown.	Unknown.	Town, Dnepr-Donets net.	PRODUCTION: UNKNOWN FIGURE IX-12.
130–131	Mariupol':*	47 06 N 37 31 E						
130	Azov I[1]**	.....	25, 000	Steam.	Unknown.	Unknown.	Iron works, Dnepr-Donets net.	PRODUCTION: UNKNOWN FIGURE IX-12.
131	Azov II[1]**	.....	24, 000	Steam.	Unknown.	Unknown.	Iron works, Dnepr-Donets net.	PRODUCTION: UNKNOWN FIGURE IX-12.
	REGION IV—SOUTHEAST (ROSTOV-NA-DONU):							
132	Kamensk[1]*	48 19 N 40 15 E	50, 000	Steam.	Unknown.	Unknown.	Industry, Dnepr-Donets net.	PRODUCTION: UNKNOWN In operation February 1944: 5,000 kw. FIGURE IX-12.
133	Krasnyy Sulin[1]*	47 53 N 40 05 E	100, 000	Steam.	Unknown.	Unknown.	District, Dnepr-Donets net.	PRODUCTION: UNKNOWN FIGURE IX-12.
134	Shakthy-Artemovskiy-GRES[1] (Regional)**	47 42 N 40 12 E	95, 000	Steam.	Unknown.	5 boilers operating, January 1944.	District, Dnepr-Donets net.	PRODUCTION: UNKNOWN In operation by Russians November 1943. FIGURE IX-12.
	REGION V—MIDDLE AND LOWER VOLGA:							
135	Zelenodol'sk*	55 50 N 48 30 E	120, 000	Steam.	Wood.	Mobile units.	Industry.	PRODUCTION: UNKNOWN Mobile railroad power plant center. 40 ten-car plants (30,000 kw. each) imported in 1944; other mobile plants with 6 to 10 cars per plant (capacity unknown) are based here.
136–139	Kazan':*	55 47 N 49 07 E						
136	Kaz-GRES I "Stalin" (Regional)**	.....	6, 000	Steam.	Coal.	2 turbo-generators, 3,000 kw. each.	City and streetcar lines.	PRODUCTION: UNKNOWN Now only auxiliary plant for Kaz-GRES II (137).
137	Kaz-GRES II (H & P)[2] (Regional)**	.....	50, 000 (1944)	Steam.	Coal, peat.	2 turbo-generators, 10,000 kw. each (1941). Additional sets installed in 1944.	India rubber plant, Kazan', Derbyshki, Biryuli, Vysokaya Gora, Kamenka.	PRODUCTION: UNKNOWN Kaz-GRES I and II belong to Kazan' Power Combine. Seven outgoing high tension lines, most important over the Kazanka river.
138	Kaz II (H&P)[2]**	.....	50, 000 (1944)	Steam.	Coal, mazut.	Unknown.	Aircraft engine plant, airframe plant.	PRODUCTION: UNKNOWN Lines to Zelenodol'sk (135).

139	Kaz III (H&P)[2]**	.....	18, 000	Steam.	Coal, petroleum.	Unknown.	"Kinoplenka" film factory, Yagodnaya Sloboda suburb.	PRODUCTION: UNKNOWN Reported capacity from 12,000 to 24,000 kw.
140	Bondyushskiy Zavod (factory plant)**	55 54 N 52 20 E	Unknown.	Unknown.	Unknown.	Unknown.	"Karpov" chemical factory, explosives.	PRODUCTION: UNKNOWN Apparently large plant. Covers area of 40 x 80 meters. Explosives plant employed 10,000 workers during the war. No further information available.
141–142	Ul'yanovsk:*	54 20 N 48 25 E						
141	Hydroelectric Station**	.....	40. 000	Hydro.	....	Unknown.	Industry.	PRODUCTION: UNKNOWN 7 to 8 kilometers west of Ul'yanovsk on the Sviyaga river. Built 1940.
142	H&P[2]**	.....	60, 000	Steam.	Petroleum.	Unknown.	Industry, city.	PRODUCTION: UNKNOWN Reported capacity form 45,000 to 75,000 kw. At "Volodarskiy" munitions factory. Enlarged with machinery evacuated from "ZIS" plant, Moscow (188).
143	Syzran' (H&P)[2]*	53 10 N 48 28 E	15, 000	Steam and diesel.	Bituminous shale, mazut.	2 diesel engines (1940).	Industry, R.R.	PRODUCTION: UNKNOWN Built 1938. Reported capacity (1944) from 10,000 to 20,000 kw. Plan; 24,000 kw. Coupled with 2,300 kw. hydroelectric plant in Syzran' and 1,000 kw. railroad plant in Batraki (10 km. E).
144	Kashpirovka*	53 03 N 48 25 E	5, 000	Steam.	Bituminous shale.	Unknown.	Chemical factory at Syzran'.	PRODUCTION: UNKNOWN
145	Krasnaya Glinka**	53 24 N 50 08 E	1, 900, 000 (Planned)	Hydro.	....	10 turbo-generators of 175,000 kw. each on hand. To be installed.	Moscow transmission system, Gor'kiy, Urals, Volga region.	PRODUCTION: 15,000,000,000 KW.-HR. (PLANNED) Part of Great Volga Project. Begun February 1942. Dam, storage installation, locks, weir, built. 300 to 400 kv. lines planned. For other section of the project see Perevoloki (149).
146–148	Kuybyshev:*	53 12 N 50 08 E						
146	H& P[2](Regional)**	.....	60, 000 (1942)	Steam.	Bituminous shale, coal, coal dust.	5 boilers, 5 turbines.	City, industries; also industries in Chapayevsk and Alekseyevsk.	PRODUCTION: UNKNOWN Being enlarged. Municipal plant.
147	Bezymyanka (H & P)[2]**	.....	100, 000 (1943)	Steam.	Coal, petroleum.	Probably 4 turbo-generators at 25,000 kw. Coal dust plant, underground oil tanks.	Aircraft plants, aircraft engine factory.	PRODUCTION: UNKNOWN Construction begun 1940. Connection to 35 kv. Kuybyshev net.
148	H&P[2]**	.....	8, 000	Steam.	Bituminous shale.	Unknown.	Explosives plant.	PRODUCTION: UNKNOWN. Connected to municipal plant (146)
149	Perevoloka**	55 15 N 49 10 E	1, 500, 000 (Planned)	Hydro.	....	7 turbo-generators, 175,000 kw. each.	Moscow-Upper Volga transmission system, railroads.	PRODUCTION: UNKNOWN Second part of Great Volga project. Begun in 1937 and discontinued in February 1942.

[1] Plant located in occupied area, or known to have been destroyed or evacuated during the war.
[2] H&P: Power plant producing heat and power. This is the translation of the Russian word TETs.
[4] These capacities are as reported, estimated, or the average of reported capacities.
* Name of city. ** Name of plant.

TABLE IX - 46 (Continued)

Plant No. (FIGURE IX-62)	Region, city,* and/or plant name**	Coordinates	Capacity [4]	Type of plant	Fuel	Equipment	Consumers	Remarks
	REGION VI: (*continued*)	° ′	*Kw.*					
150–151	Chapayevsk:*	52 58 N 49 40 E						
150	H&P[2]**	.....	7, 500	Steam.	Bituminous shale.	2—2,500 kw. turbines.	Powder factory.	PRODUCTION: UNKNOWN 35 kv. line to Kyubyshev municipal plant (146).
151	H&P[2]**	.....	6, 000	Steam.	Bituminous. shale.	5 turbines, 8 boilers.	Industry, city, Kuybyshev.	PRODUCTION: UNKNOWN. Connected to Kuybyshev municipal plant (146).
152	Vol'sk*	52 03 N 47 22 E	25, 000	Steam.	Petroleum.	Unknown.	Industry, city.	PRODUCTION: UNKNOWN
153–155	Saratov:*	51 30 N 46 00 E						
153	Sar-GRES (Regional)**	.....	100, 000 (1943)	Steam.	Hard and soft coal, anthracite dust.	7 boilers, 4 turbines—25,000 kw. each.	City and local industries; Engel's, Bal'tser, Marks.	PRODUCTION: UNKNOWN Part of "Glavenergo" power combine. Began production in 1930.
154	H&P II[2]**	.....	24, 000 (1943)	Steam.	Shale, coal dust, scrap wood.	Unknown.	Factory.	PRODUCTION: UNKNOWN Supplies steam and hot water to "Combine factory". Located on same grounds.
155	H&P III[2]**	.....	24, 000	Steam.	Coal.	Unknown.	Ball-bearing plant.	PRODUCTION: UNKNOWN At "GPS-3" ball-bearing plant. Built 1940.
156	Kamyshin*	50 05 N 45 25 E	1, 600, 000 (Planned)	Hydro.	....	8 turbo-generators of 200,000 kw. each (planned).	Baku II oil fields (planned service).	PRODUCTION: UNKNOWN Now under construction with prisoner of war labor. Turbines are to be largest ever built. One unit already constructed. Planned prior to invasion
157–159	Stalingrad:*	48 42 N 44 30 E						
157	Power Station**	.....	30, 000 (1943)	Steam.	Coal.	Unknown.	Industry, city.	PRODUCTION: UNKNOWN Site unknown. Built July 1943 (9,000 kw.). Enlarged by end of 1943.
158	"Krasny Oktyabr' "[1]** (steel plant).	.....	24, 000	Steam.	Coal.	Unknown.	Streetcar lines and small industries (1944).	PRODUCTION: UNKNOWN Destroyed during the war.
159	"Krasnyye Barrikady" [1]** (gun factory).	.....	50, 000	Steam.	Unknown.	Unknown.	Gun factory, city.	PRODUCTION: UNKNOWN Equipment destroyed during the war. In 1944 schools were receiving power, probably from this station. Power was also received from Novonikol'skoye (65 km. NE) where two hydroelectric stations of unknown capacity have been built.

160	Beketovka[1]* (Stal-GRES I)** (Regional plant).	48 37 N 44 25 E	150,000	Steam.	Coal, anthracite dust.	Unknown.	Industry, town.	PRODUCTION: UNKNOWN Reported (August 1947) fully restored. Reported capacity from 100,000 to 200,000 kw.
161–164	Astrakhan':*	46 21 N 48 04 E						
161	Municipal Plant**	.....	100,000	Steam.	Coal.	4 foreign turbines; 3 large, several small boilers, grinding mill.	City.	PRODUCTION: UNKNOWN Rebuilt in 1935.
162	H&P[2] (Regional) (old plant)**	.....	24,000	Steam.	Unknown.	2 boilers of 1,250 sq. m. from Nevskiy plant.	Industry, city.	PRODUCTION: UNKNOWN
163	H&P[2] (new plant)**	.....	12,000	Steam.	Unknown.	2—6,000 kw. turbogenerators.	Industry, city.	PRODUCTION: UNKNOWN
164	"Third International" Shipyard (factory plant)**	.....	20,000	Unknown.	Unknown.	Unknown.	Shipyard.	PRODUCTION: UNKNOWN Draws additional power from municipal plant (161).
	REGION VI—(CENTRAL INDUSTRIAL):							
165–167	Kalinin:*	56 52 N 35 54 E						
165	H&P[2]**	.....	22,000	Steam.	Peat.	4 turbines.	Part of city and surrounding industry.	PRODUCTION: UNKNOWN Equipment includes: 2 turbines at 2,000 kw. (BBC), 1 at 6,000 kw. (Elektrosila), 1 turbine at 12,000 kw. (Elektrosila). FIGURE IX-11.
166	Municipal Plant (Regional)**	.....	12,000	Steam.	Peat.	1—12,000 kw. turbine.	City.	PRODUCTION: UNKNOWN FIGURE IX-11.
167	Power Plant (Exact location unknown. Near Kalinin)**	.....	12,000	Steam.	Peat.	Unknown.	Factory.	PRODUCTION: UNKNOWN Located at silk combine. FIGURE IX-11.
168	Ivan'kovo*	56 45 N 37 88 E	30,000	Hydro.	....	2—15,000 kw. Kaplan turbines.	Moscow transmission system, Kimry.	PRODUCTION: 150,000,000 KW.-HR. (1941) 100 kv. line to Moscow, 35 kv. line to Kimry. FIGURE IX-11, TABLE IX-43.
169–170	Shcherbakov (Rybinsk):*	58 03 N 38 48 E						
169	Power Plant**	.....	12,000	Steam.	Unknown.	Unknown.	Airplane motor factory.	PRODUCTION: UNKNOWN FIGURE IX-11.
170	Hydroelectric Plant**	.....	165,000 (1945)	Hydro.	....	3 Kaplan turbines at 55,000 kw.	Moscow transmission system, Shcherbakov and vicinity, Yaroslavl'.	PRODUCTION: UNKNOWN 2—55,000 kw. turbines were installed in 1943. A third turbine was reported to have been installed (August 1945). One source states capacity of 220,000 kw. had been reached in 1944. Planned capacity is 330,000 kw. 220 kv. overhead power lines lead to Moscow via Uglich. FIGURE IX-11, TABLE IX-43.

[1] Plant located in occupied area, or known to have been destroyed or evacuated during the war.
[2] H&P: Power plant producing heat and power. This is the translation of the Russian word TETs.
[4] These capacities are as reported, estimated, or the average of reported capacities.
* Name of city. ** Name of plant.

TABLE IX - 46 (Continued)

Plant No. (FIGURE IX-62)	Region, city,* and/or plant name**	Coordinates	Capacity [1]	Type of plant	Fuel	Equipment	Consumers	Remarks
	REGION VI: (*continued*)	° ′	*Kw.*					
171	Kostroma* (H&P)[2]	57 46 N 40 58 E	11, 800	Steam.	Peat.	3 turbines, 6 boilers.	City, linen mills, shipyards machine, plywood and oil factories.	PRODUCTION: UNKNOWN 6.6 kv. cable distribution. Planned capacity: 18,000 kw. FIGURE IX-11.
172–173	Yaroslavl':*	57 37 N 39 52 E						
172	H&P[2]**	.....	49, 000	Steam.	Peat.	1—24,000 kw. turbine. 1—25,000 kw. turbine.	India rubber; asbestos combine; auto works.	PRODUCTION: UNKNOWN. One turbine manufactured by Wumag (apparently German manufacturer); one by Leningrad plant. FIGURE IX-11.
173	Yar-GRES (Regional)**	.....	87, 000 (1943)	Steam.	Peat.	6 turbines, peat grinding mill.	City and vicinity.	PRODUCTION: UNKNOWN. a.c. and d.c. 1—3,000 kw. turbine, 2—24,000 kw. turbines, 3—12,000 kw. turbines. 2—110 kv. lines to Shcherbakov. 110 kv. line to Komsomol'sk via Nerekhta transformer station. 2—35 kv. lines to transformer station "North" in Yaroslavl'. Medium tension lines for local distribution. FIGURE IX-11.
174	Uglich*	57 32 N 38 22 E	110. 000	Hydro.	....	2—55,000 kw. Kaplan turbines.	Moscow transmission system, Uglich and vicinity.	PRODUCTION: UNKNOWN Plant belongs to Yaroslavl' transmission system. Connected with Moscow transmission system by double 220 kv. line. 1—220 kv. line to Shcherbakov. Medium tension line for Uglich and vicinity. 90% of power is delivered to Moscow. Planned capacity: 220,000 kw. FIGURE IX-11. TABLE IX-43.
175	Klin*	56 20 N 36 45 E	10, 000	Steam.	Peat.	Unknown.	Munitions factory.	PRODUCTION: UNKNOWN Located near munitions factory. FIGURE IX-11.
176	Mo-GES III "Klasson"**	55 51 N 38 46 E	150, 000 (Est. 1947)	Steam.	Peat.	5 turbines, 13 boilers.	Armament, steel and textile industries Moscow transmission system.	PRODUCTION: UNKNOWN Equipment partly removed during the war. Capacity restored to 40,000 in 1944. 110 kv. lines to Moscow and Noginsk. Location is in Elektroperedacha. FIGURE IX-11.
177	Roshal' (H&P)[2]*	55 41 N 39 54 E	10, 000	Steam.	Peat.	4 old, 6 new turbines.	Powder and explosives plant.	PRODUCTION: UNKNOWN FIGURE IX-11.
178	Tushino* "Zhodnenskaya"**	55 48 N 37 25 E	30, 000	Hydro.	....	2—15,000 kw. turbines.	Moscow Volga canal.	PRODUCTION: UNKNOWN 110 kv. line to Fili. 35 kv. line to Butyrki. FIGURE IX-11.

Approved For Release 2003/05/14 : CIA-RDP79-01144A000200010009-0

179–189	Moscow:*	55 47 N 37 40 E						
179	Lyublino[1]**	.....	8, 500	Hydro.	....	Unknown.	Imeni-Moskvy Kanal, Moscow transmission system.	PRODUCTION: UNKNOWN Moscow-Upper Volga transmission system (Figure IX-11). Belongs to electric plant of Imeni-Moskvy Kanal.
180	Mo-GES I ("Smidovich")**	.....	125, 000	Steam.	Lignite, coal.	12 turbines, 16 boilers.	Moscow transmission system.	PRODUCTION: UNKNOWN Partly evacuated during war period. Capacity, 1942 to 1944: 45,000 kw.
181	"Krasnaya Presnya"**	.....	12, 000	Steam.	Coal, mazut.	2 turbines.	do.	PRODUCTION: UNKNOWN
182	"VTI" (H&P)[2]**	.....	70, 000 (Est. 1947)	Steam.	Coal, peat, mazut.	5 turbines, 5 boilers, coal grinding mill.	do.	PRODUCTION: 339,700,000 KW.-HR. (1939). The "VTI" is the most modernly equipped research institute for thermo-technical experiments. Its high pressure plant has 3 boilers with steaming capacities of 160 metric tons per hour, 1—12,000 kw. turbine, 2—24,000 kw. turbines. The low pressure plant has 2 boilers, 1—2,500 kw. and 1—1,100 kw. turbine. Connection to Moscow transmission system via transformer station "Kozhukhovo". Capacity in 1942 reduced to 40,000 kw.
183	"Stalin" (H&P)[2]**	.....	75, 000 (1944)	Steam.	Lignite, mazut.	4 boilers, 3 turbines at 25,000 kw.	do.	PRODUCTION: 547,900,000 KW.-HR. (1939). Capacity of plant may have been raised to 100,000 kw. Russian sources report new 25,000 kw. turbine completed for this station July 1946.
184	"Frunze" (H&P)[1,2]**	.....	50, 000 (1947)	Steam.	Coal, mazut.	Unknown.	Industry, city.	PRODUCTION: UNKNOWN Russian sources state prewar capacity to be doubled. Equipment evacuated in wartime.
185	"Semenov"**	.....	24, 000 (Planned)	Steam.	Unknown.	Unknown.	Industry, city.	PRODUCTION: UNKNOWN Begun 1939. Under construction 1942.
186	"Leningrad" (H & P)[2]**	.....	24, 000 (Planned)	Steam.	Unknown.	....	....	PRODUCTION: UNKNOWN Under construction since 1939.
187	Mo-GES II (H & P)[2,3]**	.....	36, 000	Steam.	Coal, mazut.	4 turbines.	Municipal streetcar lines. Heats government buildings, Kremlin.	PRODUCTION: 183,800,000 KW.-HR. (1939). Two turbines evacuated during the war.
188	"ZIS" (H & P)[1,2]**	.....	75, 000	Steam.	Lignite, coal, mazut.	25,000 kw. turbine.	Moscow transmission system.	PRODUCTION: UNKNOWN Plant completely evacuated 1941; in operation 1943. Capacity in 1944: 24,000 kw.
189	H & P VIII[2]**	.....	4, 000	Steam.	Coal, mazut.	1 turbine.	Industry, city.	PRODUCTION: UNKNOWN
190	Orekhovo-Zuyevo (H & P #6)[2]*	55 47 N 39 01 E	30. 000	Steam.	Peat, lignite.	4 turbines.	Moscow transmission system.	PRODUCTION: UNKNOWN 110 kv. line to Noginsk and Roshal'. Some turbines probably evacuated during the war. FIGURE IX-11.

[1] Plant located in occupied area, or known to have been destroyed or evacuated during the war.
[2] H&P: Power plant producing heat and power. This is the translation of the Russian word TETs.
[3] GES: Hydroelectric station. Frequently used as a suffix to indicate the plant type, e.g., Dnepro-GES. However, note that stations belonging to the Moscow power system are "Mo-GES I, Mo-GES II", etc., and are thermal stations.
[4] These capacities are as reported, estimated, or the average of reported capacities.
* Name of city. ** Name of plant.

Confidential

TABLE IX - 46 (Continued)

Plant No. (FIGURE IX-62)	Region, city,* and/or plant name**	Coordinates	Capacity [4]	Type of plant	Fuel	Equipment	Consumers	Remarks
		° ′	*Kw.*					
	REGION VI: (*continued*)							
191	Kashira* (Mo-GES IV)[1,3]** "Kaganovich"**	54 52 N 38 13 E	220, 000	Steam.	Lignite.	13 boilers, 7 turbines.	do.	PRODUCTION: UNKNOWN 3 overhead lines of 110 kv. to Moscow. Branches to Stupino and Podol'sk. One overhead power line of 110 kv. to Moscow-Karacharevo; also to Tula, Serpukhov, Stalinogorsk, Ryazan' via Zaraysk-Kolomna. Medium tension for Kashira and vicinity. Delivers power to armament industry of Stupino, Podol'sk, Ryazan' as well as the textile industry of Kashira. In 1941 the plant was almost completely evacuated. By January 1943, however, it was again in full operation. FIGURE IX-11.
192	Shatura* (Mo-GES V)[1,3]** "Lenin"**	55 34 N 39 34 E	225, 000	Steam.	Peat.	18 boilers, 6 turbines.	Moscow transmission system armament industry of Elektrostal', Noginsk, Yegor'yevsk, Voskresensk. Textile industry.	PRODUCTION: UNKNOWN Overhead power lines to Moscow: 2—110 kv. via Noginsk. 2—110 kv. lines via transformer station Kirovskaya and Ramenskoye; to Kashira (191): one 110 kv. line via Kolomna, Yegoryevsk and branches to Voskresensk, 2—35 kv. lines to the peat bogs Shaturtorf and Kobelevskaya. To Gus'-Khrustal'ny: 1 line of 110 kv. via Roshal', 2 lines of 35 kv. Restored capacity 180,000 in 1944. FIGURE IX-11.
193	Serpukhov*	54 54 N 37 26 E	10, 000 (1942)	Steam.	Coal.	Unknown.	Textile factory, local industries.	PRODUCTION: UNKNOWN Tied in with Moscow and Kashira by 110 kv. FIGURE IX-11.
194	Stalinogorsk (H&P #10)[1,2]*	54 04 N 38 15 E	350, 000	Steam.	Lignite.	12 boilers, 6 turbines.	Moscow transmission system, Stalinogorsk. Chemical industry, mining. Tula armament industry.	PRODUCTION: UNKNOWN To Moscow: 2—220 kv. lines to the transformer station Butyrki, 1—110 kv. line to transformer station Reutovo. To Tula: 110 kv. overhead line. To Kashira (191): 110 kv. overhead line. Capacity in 1943—150,000 kw. Soviet sources state station now completely restored. FIGURE IX-11.
195	Aleksin[1]*	54 32 N 37 06 E	50, 000 (1943)	Steam.	Coal, coal dust.	2—25,000 kw. turbines.	Tula and Serpukhov. Probably explosives plant.	PRODUCTION: UNKNOWN Connected to Tula (197) and Serpukhov (193) by 110 kv. overhead power line. FIGURE IX-11.
196	Kaluga[1]*	54 32 N 36 17 E	12, 000	Steam.	Coal.	Unknown.	Industry, town.	PRODUCTION: UNKNOWN
197	Tula*	54 13 N 37 37 E	60, 000 (1944)	Steam.	Lignite.	4 boilers, 2—24,000 kw. turbines.	Moscow transmission system. Probably metal combine.	PRODUCTION: UNKNOWN 2—110 kv. lines to Kashira (191). 110 kv. line to Aleskin (195) and Stalinogorsk (194). Probably 35 kv. connection via transformer to metal combine. FIGURE IX-11.

198	Yefremov[1]*	53 10 N 38 05 E	12, 000	Steam.	Coal.	Unknown.	Industry, town.	PRODUCTION: UNKNOWN FIGURE IX-11.
199	Ryazan' (H&P)[2]*	54 37 N 39 47 E	24, 000	Steam.	Lignite.	Unknown.	City and local industries.	PRODUCTION: UNKNOWN 110 kv. line via transformer station Zaraysk to Kashira. 35 kv. line (probably) to Shatura (192). FIGURE IX-11.
200	Skopin*	53 49 N 39 33 E	24, 000	Steam.	Coal.	Unknown.	City industries, coal mine.	PRODUCTION: UNKNOWN
201	Kursk[1]*	51 44 N 36 12 E	24, 000	Probably steam.	Unknown.	Unknown.	Streetcars, waterworks.	PRODUCTION: UNKNOWN Kursk is in the central agricultural region of European Russia. There is little to show that this area has had much electric power development.
202	Lipetsk (H&P)[2]*	52 38 N 39 35 E	49, 000 (1944)	Steam.	Mixed.	1—24,000 kw. turbogenerator. 1—25,000 kw. turbogenerator.	Armament plant, carbide factory, mine.	PRODUCTION: UNKNOWN 110 kv. line to Voronezh (203).
203	Voronezh*	51 39 N 39 12 E	60, 000	Steam.	Coal.	Unknown.	Voronezh industries.	PRODUCTION: UNKNOWN May have been in occupied territory.
204	Komsomol'sk Iv-GRES (Regional)**	57 01 N 40 23 E	124, 000 (1943)	Steam.	Peat.	6 turbines, 8 boilers.	Ivanovo: textile industry. Yaroslavl': machine and textile industry. Nerekhta: textile and lumber industry. Shuya: textile and lumber industry. Kovrov: armament industry.	Coupled with the Yaroslavl' and Gor'kiy power system. 110 kv. lines to Yaroslavl' and Nerekhta. 110 kv. line to Shuya and Kovrov (Vyazniki and Gor'kiy) 2—110 kv. lines to transformer station in Ivanovo. Plant belongs to the Ivanovo transmission system. Peat is obtained from the marshes at Markov and Teykovo, 7 to 12 km. away. FIGURE IX-11.
205–206	Ivanovo:*	57 01 N 41 00 E						
205	H&P II[2]**	.....	14, 000	Steam.	Peat, wood.	3 turbines.	Industry, city.	PRODUCTION: UNKNOWN Several 35 kv. lines to supply city and industries. 35 kv. cable (1.5 to 2 meters deep) to Pushkin Square (municipal theater) and "Katonin" rope factory. FIGURE IX-11.
206	H&P III[2]**	.....	24, 000	Steam.	Peat.	1 turbine (1941).	....	PRODUCTION: UNKNOWN Probably in or near Ivanovo. FIGURE IX-11.
207	Vladimir (H&P)[2]*	56 09 N 40 25 E	7, 500	Steam.	Peat.	Unknown.	Chemical plant and other industries.	PRODUCTION: UNKNOWN 110 kv. line via Kovrov, Shuya to Ivanovo. 110 kv. line via Vyazniki to Gor'kiy. Reported capaccity from 5,000 to 10,000 kw. FIGURE IX-11.

[1] Plant located in occupied area, or known to have been destroyed or evacuated during the war.

[2] H&P: Power plant producing heat and power. This is the translation of the Russian word TETs.

[3] GES: Hydroelectric station. Frequently used as a suffix to indicate the plant type, e.g., Dnepro-GES. However, note that stations belonging to the Moscow power system are "Mo-GES I, Mo-GES II", etc., and are thermal stations.

[4] These capacities are as reported, estimated, or the average of reported capacities.

* Name of city. ** Name of plant.

TABLE IX - 46 (Continued)

Plant No. (FIGURE IX-62)	Region, city,* and/or plant name**	Coordinates	Capacity [4]	Type of plant	Fuel	Equipment	Consumers	Remarks
		° ′	*Kw.*					
	REGION VI: (*continued*)							
208–209	Balakhna:*	56 31 N 43 32 E						
208	Balakhninskaya (H&P)[2]**	.....	35, 000 (1943)	Steam.	Peat.	Unknown.	"Dzerzhinsk" paper and cellulose combine.	PRODUCTION: UNKNOWN 4 km. N of Balakhna (Go-GRES I) (209). Coupled with Go-GRES I and Sormovo; takes 50,000 kw. from Go-GRES I. FIGURE IX-11.
209	Go-GRES I (Balakhna) (Regional)**	.....	204, 000	Steam.	Peat, coal mazut.	3 boiler houses, probably 36 boilers; 12 using peat, 12 coal dust; all can use mazut; grinding mill 8 turbines: 2—10,000 kw., 3—24,000 kw., 1—22,000 kw., 2—44,000 kw.	Dzerzhinsk chemical combine and explosives factory; industries in Gor'kiy, Pavlovo, Kulebaki, Vyksa, Murom, and Arzamas.	PRODUCTION: UNKNOWN Most important power plant in Gor'kiy region. Coupled with Go-GRES II, Sormovo and Ivanovo. FIGURE IX-11.
210–212	Gor'kiy:*	56 20 N 43 59 E						
210	"Sormovo" (H&P)[2]**	.....	100, 000	Steam.	Peat, mazut.	9 boilers, 2—50,000 kv. turbines.	"Novoye Sormovo" gun factory; other armament factories in Sormovo-Kanavinsk.	PRODUCTION: UNKNOWN Part of Gor'kiy transmission system. May be rebuilt or replaced by high pressure steam plant of greater efficiency. FIGURE IX-11.
211	Municipal (H&P)[2]**	.....	24, 000	Steam.	Coal, mazut.	2—12,000 kw. turbines.	City and industries on right side of Oka River.	PRODUCTION: UNKNOWN Connected with Go-GRES I and II (209, 212), "Molotov" auto factory H&P, Sormovo (210) and Dzerzhinsk (213). FIGURE IX-11.
212	Go-GRES II (H&P)[2] (Regional)**	.....	124, 000	Steam.	Mazut, coal.	Old building: 5 boilers; 4 turbines: 2—12,000 kw., 2—25,000 kw. New building: 2 boilers; high pressure controlled turbines. 50,000 kw. total.	Auto works, city and vicinity.	PRODUCTION: UNKNOWN Located at "Molotov" auto plant. Connected to Gor'kiy transmission system. Fourth Five-Year Plan states this plant to be "built up to planned capacity". FIGURE IX-11.
213	Dzerzhinsk (H&P)[2]*	56 15 N 43 30 E	50, 000	Steam.	Coal, mazut.	2—25,000 kw. turbines, boiler house, cooling towers.	Industry of Dzerzhinsk.	PRODUCTION: 300,000,000 KW.-HR. Coupled with Go-GRES I and II (209, 212), "Molotov" power plant, Sormovo, Gor'kiy H&P; industrial plants of Dzerzhinsk partially connected with cable lines. Fourth Five-Year Plan provides for

								increase to planned capacity (100,000 kw.). FIGURE IX-11.
214	Kulebaki (H&P)[2]*	55 25 N 42 32 E	12,000 (1937)	Steam.	Peat.	Unknown.	"Kirov" steel plant.	PRODUCTION: UNKNOWN Double 110 kv. line via Dzerzhinsk (213) to Balakhna (209). Coupled with Vyksa (215), Doshchatoye, Murom; probably also Arzamas. FIGURE IX-11.
215	Vyksa*	55 21 N 42 11 E	12,000	Steam.	Peat.	Unknown.	"VMZ" metallurgical plant; "DRO" machine factory; shipbuilding.	PRODUCTION: 190,000,000 KW.-HR. Coupled with Kulebaki (214). FIGURE IX-11.
216	Saransk*	54 12 N 45 12 E	10,000 (1941)	Steam.	Peat.	Unknown.	City and vicinity. Industries.	PRODUCTION: UNKNOWN Built 1938.
217	Morshansk*	53 37 N 41 48 E	20,000	Hydro.		12 turbines.	Industry.	PRODUCTION: UNKNOWN Began operations 1939.
218–219	Tambov:*	52 43 N 41 26 E						
218	"Krasny Oktyabr' " (H&P)[2]**	.....	48,000 (1943)	Steam.	Coal	3 turbines (1941).	Powder factory.	PRODUCTION: UNKNOWN At "Krasny Bol'shevik" powder factory.
219	H&P[2]**	.....	24,000	Steam.	Unknown.	Unknown.	Rubber factory. Industry.	PRODUCTION: UNKNOWN At India rubber plant.
220	Kobrin,* "Sinegorskiy"** (H&P)[2]	59 20 N 50 54 E	Probably. 50,000	Steam.	Bituminous shale.	Unknown.		PRODUCTION: UNKNOWN Status of construction unknown. Plan to increase to 250,000 kw.
221	Kirs (H&P)[2]*	59 20 N 52 13 E	Unknown.	Steam.	Peat, wood.	Unknown.	"Kirsinskiy" rolling mill.	PRODUCTION: UNKNOWN To be coupled with Glazov (Udmurtskaya ASSR) (230) and Omutninsk. (222).
222	Omutninsk* "Fosforitnaya" (H&P)[2]**	58 37 N 52 10 E	24,000	Steam.	Peat, coal.	Probably 2—12,000 kw. turbines. In addition old water driven plant.	Steel plant, city and vicinity.	PRODUCTION: UNKNOWN
223	Slobodskoy* "Oglobin" (H&P)[2]**	58 45 N 50 10 E	24,000	Steam.	Peat.	2—12,000 kw. turbines.	Industry.	PRODUCTION: UNKNOWN Probably 110 kv. line to Kirov.
224–225	Kirov:*	58 35 N 49 40 E						
224	Municipal Plant**	.....	17,500	Unknown.	Mixed.	Unknown.	City.	PRODUCTION: UNKNOWN Reported capacity from 10,000 to 25,000 kw.
225	H&P[2]**	.....	60,000	Steam.	Peat.	3—12,000 kw. turbines, 3—25,000 kw. turbines. (Probably only half completed.)	Industry, city and vicinity.	PRODUCTION: UNKNOWN To be coupled with Glazov (230), Kotel'nich, and Slobodsky (223).

[2] H&P: Power plant producing heat and power. This is the translation of the Russian word TETs.
[4] These capacities are as reported, estimated, or the average of reported capacities.
* Name of city. ** Name of plant.

TABLE IX - 46 (Continued)

Plant No. (FIGURE IX-62)	Region, city,* and/or plant name**	Coordinates	Capacity [4]	Type of plant	Fuel	Equipment	Consumers	Remarks
		° ′	*Kw.*					
	REGION VI: (*continued*)							
226	Ust'-Cheptsa (Regional)*	58 32 N 50 02 E	50, 000	Steam.	Peat.	Probably 2—25,000 kw. turbines.	City of Kirov and industries.	PRODUCTION: UNKNOWN Still under construction in 1942. Probably half completed in 1943. Planned capacity: 100,000 kw. Plant has narrow gage railroad to peat-yard.
227	Vyatskiye Polyany (H&P)[2]*	56 15 N 51 02 E	3, 000	Steam.	Coal, wood.	Unknown.	Armament plant.	PRODUCTION: UNKNOWN Evacuated in 1941 from Zagorsk. Planned capacity: 12,000 kw.
228	Volzhsk (H&P)[2]*	55 53 N 48 18 E	17, 500	Steam.	Peat, wood.	4 boilers.	Industry, town.	PRODUCTION: UNKNOWN To be coupled with Vurnary H&P (229). The Mariyski cellulose and paper combine located in the area has its own power plant of unknown capacity.
229	Vurnary (H&P)[2]*	55 33 N 46 06 E	50, 000	Steam.	Bituminous shale.	2—25,000 kw. turbines.	Phosphorous and shale mines; industries of Alatyr'.	PRODUCTION: UNKNOWN Coupled with Volzhsk (228), Shumerlya, Cheboksary.
	REGION VII—URALS:							
230	Glazov (H&P)[2]*	58 08 N 52 41 E	12, 000	Steam.	Peat.	Unknown.	Spinning combine and textile machinery factory.	PRODUCTION: UNKNOWN To be connected with Izhevsk, Kirov (225), Kirs (221).
231–232	Votkinsk:*	57 03 N 53 57 E						
231	Hydroelectric Plant**	.....	17, 500	Hydro.	....	2 turbines.	Machine factory.	PRODUCTION: UNKNOWN Reported capacity from 10,000 to 25,000 kw.
232	Factory Plant**	.....	24, 000	Steam.	Coal.	Enlarged by 1 set of 12,000 kw. turbines and 3 boilers of 750 sq.m.	Armament plant.	PRODUCTION: UNKNOWN Coupled with Votkinsk hydroelectric plant (231).
233–234	Izhevsk:*	56 52 N 53 06 E				4 turbines.	Industry.	PRODUCTION: UNKNOWN Location: above Izhevsk at west end of dam; reservoir 12 to 15 km. long, width 1.5 km., average depth 15 m., falls 15 to 18 m.
233	Hydroelectric Plant**	.....	40, 000	Hydro.	....			
234	Factory Plant**	.....	48, 000	Steam.	Mixed.	4—12,000 kw. turbines.	Iron alloy plant; armament plant; city.	PRODUCTION: UNKNOWN Located at iron alloy plant.
235	Sarapul (Regional Plant)*	56 29 N 53 47 E	Probably 24, 000	Steam.	Peat.	Unknown.	City; "Ordzhonikidze" electro-mechanical plant.	PRODUCTION: UNKNOWN Municipal plant with additional district distribution.

[2] H&P: Power plant producing heat and power. This is the translation of the Russian word TETs.
[4] These capacities are as reported, estimated, or the average of reported capacities.
* Name of city. ** Name of plant.

97. MANUFACTURING

A. General

At the beginning of World War II, most of the Soviet population, industry, agriculture, and railroads were concentrated in European USSR. Because economic strength was not evenly distributed throughout the country, major dislocations were experienced during the war. In 1940 industry was located as follows:

Area	Percent
Moscow-Gor'kiy	30.0
Ukraine	18.5
Leningrad	14.0
White Russia	2.0
Other USSR	35.5
	100.0

The distribution shown above meant that when the Germans captured the Ukraine and White Russia, besieged Leningrad, and invested Moscow, they acquired some 20% of Soviet industry, besieged 14% more, and placed an additional 30% within range of their medium-bomber aircraft. At least 25% of prewar Soviet industry was destroyed during the conflict, with much of the destruction being carried out by the Soviet armies themselves. To prevent exploitation by the Germans the USSR attempted to destroy all production and transport facilities which could not be evacuated. So effective was this policy that the Donets basin, while in the hands of the Germans in 1942 produced at only 5% of the 1940 level. Although agricultural data are fragmentary the Soviet armies apparently found upon reconquest only about 25% of peacetime acreage planted in the Ukraine east of the Dnepr.

The greatest single weakness in the Soviet economy is the disorganization still prevailing in the former German-occupied areas of the country. Even with reparations and possible imports from other nations, reconstruction will not be completed before the end of the fifth Five-Year Plan, or 1956. Accessions of territory to the Soviet Union in World War II did not completely offset Soviet loss of human life, estimated at 25,000,000, or economic damage.

The factors that led to the prewar supremacy of European USSR in the economy of the Soviet Union will cause a renewal of its productivity. With no convenient source of high-grade iron or coal, or other important industrial raw material, Leningrad and Moscow each had a prewar production over three times that of any of the other cities of the Soviet Union. They took the lead in manufacturing machine tools, chemicals, wearing apparel, and household goods because the population of those areas, in terms of the USSR as a whole, is exceptionally intelligent, skilled, and hard working. The industrial heart of the country extends east to Gor'kiy and south to Tula. The same highly favorable juxtaposition of iron and coking coal that brought the Donets Basin into prominence as a metallurgical center is guarantee that it will make a comeback. The center of gravity of Soviet industry, however, has moved east to the Urals. The Soviet Union emerged from the World War II with new heavy industrial centers in other parts of the Union. The older parts of the country will surpass their prewar productive capacity in time, but will not dominate the Union industrially again.

(1) Planning

When the USSR announced its intention to overtake and surpass the capitalistic world economically by means of a series of Five-Year Plans, it set a goal difficult to attain. Prerevolutionary Russia was predominantly agricultural with little industrial development. The effort for World War I and the Revolution reduced even that small industry, and the prewar level of industrial production was not regained until 1926. Early experiments with communism were so disastrous to the nation that they necessitated partial restoration of private enterprise from 1921 until 1928—the period of the so-called New Economic Policy. The Five-Year Plan period commenced in 1928 and continued until interrupted by the German attack of June 1941. The first and second Five-Year Plans were completed, and the third was in progress at the outbreak of Soviet-German hostilities. During the Five-Year Plan period (1928-41), large heavy industries were built, some in relatively invulnerable regions remote from the frontiers.

During the second Five-Year Plan, agriculture was almost completely collectivized, despite bitter opposition from agricultural elements. In spite of opposition, however, initial reverses in production were overcome and 3,000,000 private farmers liquidated. Introduction of modern farming methods freed many peasants from agriculture and converted them into a labor surplus for expanding industry.

The Five-Year Plans gradually strengthened Soviet economy. At the beginning of World War II the Soviet Union had the third largest industry in the world, following those of the United States and Germany. It is now second. In announcing the fourth Five-Year Plan in 1946, Soviet officials stated plainly the over-all economic objective of the USSR—to increase its military-economic potential to such a degree that the country will be safe in the future against "any contingencies." Heavy industry still receives the major part of Soviet effort. Leaders speak of improving the lot of workers and peasants, but the first postwar Five-Year Plan holds little promise of restoring depleted inventories of consumer goods for some years to come, or of providing adequate housing. The immediate Soviet objective appears to be the attainment, within a 15-year period, of the aggregate heavy industry output level reached by the United States in 1939. Such a goal appears entirely feasible in aggregate, though not in per capita, terms. By 1970, further industrialization may provide living standards that will compare favorably with those prevalent in the United States in 1947.

(2) Organization

The Soviet organization for economic planning was so adaptable to war that it continued in 1939 and 1941-45 almost unchanged. Soviet terminology describes its present system as "socialism," a step toward "communism." The distinction is said to be that people are now paid according to their work but under communism will be paid according to their needs. The Soviet economic system may be characterized as totalitarian; that is, the individual is completely subjugated to the state. Private enterprise is confined largely to a few private farmers and artisans. Collective farmers can also have private gardens from which they can sell produce in open markets to the public. All other means of production and commerce are under state ownership and control. Private property is permitted to the extent of personal effects, household equipment, homes, and savings.

The economy of European USSR and the Soviet Union as a whole is directed from Moscow. Highest economic control in the USSR lies in the Council of Ministers. Every industry and important phase of economy has its own ministry, as for example, the textile industry, electric power industry, and aviation industry. Certain industries

have two ministries, West and East. These are the coal, oil, and fish industries. There are Union Republican Ministries, with branches in the capitals of each of the sixteen constituent republics of the Soviet Union and All-Union Ministries, whose grip upon individual industries runs officially, as well as in fact, from Moscow direct to the Oblast (abbreviation O.). Two of the ministries have an extensive variety of highly secret industrial establishments under their control. One is the Ministry of the Armed Forces and the other is the Ministry of Internal Affairs (MVD), lineal descendant of NKVD, GPU, and Cheka. Within ministries are trusts and administrations, which are regional organizations and deal directly with industrial establishments. Not to be confused with the administrations, subordinated to ministries, are the five chief administrations. These, and five Committees (on weights and measures, broadcasting, etc.) report directly to the Council of Ministers. Beneath the Council of Ministers, also, are the Council for Collective Farm Affairs; the State Bank; and the State Planning Commission. This last is charged with the preparation of Five-Year, annual, and quarterly plans for the entire economy. The Planning Commission (or Gosplan) prescribes Five-Year Plans for constituent republics, as well as for ministries, chief administrations, and committees.

Most industrial workers are organized in national labor unions, which have a central combined headquarters. This headquarters is virtually a government agency. Most high economic administrative officials must be Communist Party members. Supreme administrative, party, and labor union organs cooperate so closely that their moves are identical, and all three strictly control their subordinates. Added to this control is over-all supervision by the secret police. Operation of Soviet economy is often inefficient, but control is very strong, as proven by the absence of strikes.

The vast majority of peasants are on collective farms (or kolkhozy) which are associations for common production, averaging about 75 families. The state takes a lion's share of surplus output by means of fixed levies in kind purchased at a low price. The remaining collective farm surplus may be sold on open markets to the public. Kolkhoz income is divided among collective farmers in proportion to their work. State farms (or sovkhozy) operated like factories with salaried workers, have been less successful and are now maintained chiefly as experimental farms. The small number of individual farmers remaining are being taxed out of existence.

The war advantages of the Soviet economic system are many: 1) absolute control by the government in peace makes new state controls in time of war unnecessary—war planning, plant conversion to war output, industrial evacuation, and economic warfare become far easier; 2) uneconomic war preparations are far easier, since the people are not consulted and the state is virtually the sole entrepreneur; 3) cross-hauls of identical products by transport are obviated, since Soviet organizations do not compete with one another; 4) machinery is more uniform than in capitalist countries; 5) strong labor control obviates strikes and aids war mobilization; and 6) the USSR does not need to finance war in the same manner as capitalist countries, but can allot goods and services where it wishes.

Disadvantages of the Soviet system for war include: 1) a huge bureaucracy with confusion, red tape, waste of manpower on unnecessary overhead, and inertia arising from the refusal of minor officials to accept responsibility; 2) ignorant and unskilled labor as a result of inadequate education; and 3) poor planning. Integration of industry is incomplete. As an enterprise cannot count upon receiving its requirements as it needs them from other enterprises, it tends to duplicate the facilities of its suppliers.

(3) War Damage

The only major evacuation in the USSR occurred in heavy industry, and comprised mainly munition, machine building, and chemical plants. This is reflected in the first item of TABLE IX-47. For all other items mentioned, evacuation was very small and amounted to an insignificant percentage of the national total. Thus, for most items the production capacity lost through invasion is roughly the same as originally located in the invaded area (TABLE IX-47).

TABLE IX - 47

PROPORTIONS OF TOTAL SOVIET INDUSTRY AND AGRICULTURE IN GERMAN-OCCUPIED AREA, FEBRUARY 1943

Item	Originally in occupied area	Never evacuated from occupied area
	Percent	*Percent*
All industrial output capacity	33	25
Coal mines	61	61
Oil fields	15	15
Power stations	48	48
Blast furnaces	69	69
Steel furnaces	54	54
Coke batteries	66	66
Iron ore mines	65	65
R.R freightcar-building plants	45	45
Lumber-cutting camps	32	32
Sawmills	41	41
Plywood plants	56	56
Match factories	56	56
Paper mills	34	34
Tractors	26	26
Combines	27	27
All crop acreage	47	47
Grain acreage	30	30
Cattle herds	37	..
Hog herds	57	..
Sheep and goat herds	12	..
Horse herds	64	..

In compiling the tabulation on production capacity lost during the war, it was found impossible to separate production losses from invasion, evacuation, and conversion, and they are therefore combined. The general method used was to estimate the total loss from the outset to the end of the war.

WARTIME LOSS, PERCENT OF PREWAR NATIONAL OUTPUT

	Percent
Grain harvest	38
Sugar output	71
Steel output	63
Coal output	29
Oil output	51
R.R. freight car building capacity	80
Aluminum output	35
Electric power capacity	48
Motor truck output	47
Airplane production	24
Tank production	33

(4) Reconversion, reconstruction, and reparations

(a) Reconversion.—In general, the reconversion of the armaments and munitions industry was delayed for six months to a year after the end of hostilities. An exception was that portion of the ammunition industry which started conversion to agricultural machinery late in 1944. Total industrial production in 1945 was only a few percent below that of 1940. This reflected a high level of armaments production and showed that reconversion for the USSR was still a problem to be solved in order to reestablish prewar levels of production.

The fact that total industrial production in 1945 was close to that of 1940, although the production of basic raw materials and most manufactures was well below 1940 levels, showed a concentration of production as compared with 1940 in the machinery industries (which in 1945 were producing armaments but in 1947 presumably would be producing industrial, agricultural, and transport equipment in large part). This high level of machinery output augurs well for the success of the over-all capital investment program of the fourth Five-Year Plan. Russia's ability to produce agricultural, transport, and industrial equipment is greatly improved as a result of the War.

Great progress will have to be made, however, before prewar levels of production have been reestablished in many lines. Transport, fuels, and ferrous metals in particular are in a relatively poor state and obviously are bottlenecks in economic development.

Even if all industry was operating at the prewar (1940) level there would still be great shortages because maintenance of plant during the war was deferred, and great consumption needs were postponed.

The end of the War thus found the Soviet Union in an operating condition but with a badly unbalanced economy, capable, however, of carrying out a large capital investment program and of regaining its prewar position.

(b) Reconstruction.—Some 5,900 industrial enterprises were damaged or destroyed in the enemy-occupied territories of European USSR during the War. Of these approximately half were totally destroyed. For instance, all nonstructural parts (power-generating equipment, flood gates, etc.) of the Dnepr (river) hydroelectric installation (FIGURE IX-28) were totally destroyed or removed, although the main concrete structure stood.

Reconstruction lagged behind the very ambitious plans laid down for it. (FIGURE IX-29 shows restoration in progress at the Dnepr plant. The first postwar generator went into operation in 1947.) The initial goal of full reconstruction by 1950 has been abandoned officially. Despite the fact that reconstruction is not going as fast as had been anticipated, accomplishments of no mean order have been made. To 23 December 1946, 21 blast furnaces, 58 steel-smelting units, 60 rolling and pipe mills, and 71 coking batteries had been recommissioned in the Ukraine. Out of a prewar total of 279 big coal and iron mines, 138 have been restored, in addition to 438 smaller mines. Donets Basin coal output has reached 52% of the prewar level. Rehabilitation of power capacity in the Ukraine, reduced to only 0.4% of prewar capacity upon the departure of the Germans, reached almost 70% by year-end.

Shortages of all forms of transportation continue to be the major deterrent to Soviet economic recovery. Rolling stock is far below requirements and is generally in poor condition. An enormous amount of deferred maintenance resulting from the war years has still to be made good. Although 500 large and medium railroad bridges have been "restored" (often through the use of temporary materials) in the formerly occupied territories, restoration of all railway bridges destroyed during the war is not scheduled for completion until 1948.

Throughout the Soviet Union, about 800 government enterprises were built or restored and began production in 1946; by August 1946 plants were opening at the rate of three a day. Using capital construction effected in the USSR in 1945 as a basis, increases for 1946 are given below, in percentages based on 1926-27 ruble values:

	PERCENT
Coal industry	20
Iron, steel, and nonferrous metals	16
Civilian engineering	12
Power stations	10
Light and food industries	67
Transport	14
Housing construction	15

The increase in capital construction work in 1946 in the national economy as a whole was 17% over that of 1945. Most of this activity took place in European USSR. It was achieved at the cost of giving overriding priorities in manpower and materials to factory construction. Meanwhile there was a drastic shortage of housing; the windows of dwellings in entire cities were boarded up for lack of window glass; utilities functioned precariously. A decrease in the rate of reconstruction may be expected for 1947, for the following reasons: 1) There is an imperative need to raise the efficiency of labor through the provision of more housing; 2) as soon as part of a factory has been repaired, production is started without waiting for the rest of the work to be finished (reconstruction is then continued, but the plant is termed "restored"); 3) most of the more difficult tasks of reconstruction were postponed in favor of tasks which could be completed rapidly; and 4) the amount of capital goods seized in Soviet-occupied countries abroad will diminish greatly, as this program nears its completion.

(c) Reparations.—A stenographic report of the October 1946 budget session of the Supreme Soviet of the USSR included an item, "income in replacement to the Soviet Union of losses suffered as a result of military action and occupation of Soviet territory, and special incomes." This heading is taken to mean seizures of all sorts in Soviet-occupied territory. Assuming that capital goods amounted to three-quarters of the total figure given, then plant seizures amounted to over two billion dollars, or about one-fifth of the total planned capital investment program of the USSR for 1946. It is of interest, for purposes of comparison, to note that United States lend-lease assistance, together with British and Canadian mutual aid to the USSR appeared in the Soviet budget, at least in part, under the heading of "customs duties." The combined totals were four billion dollars for 1944 and 4.6 billion dollars for 1945 at the official exchange rate. While some industrial machinery seized as reparations has been installed east of the Volga, especially in the Khabarovskiy Kray of the Soviet Far East, most has been used to restore war-damaged factories in European Russia. Total plant seizures are not believed to exceed five billion dollars in value.

(5) Multiplication of products

A trend toward a greater variety of products has been established since World War II. In the past it has been a basic tenet of Soviet economic planning to restrict production to an extremely small number of standard products. This has led to such dangerous extremes as the

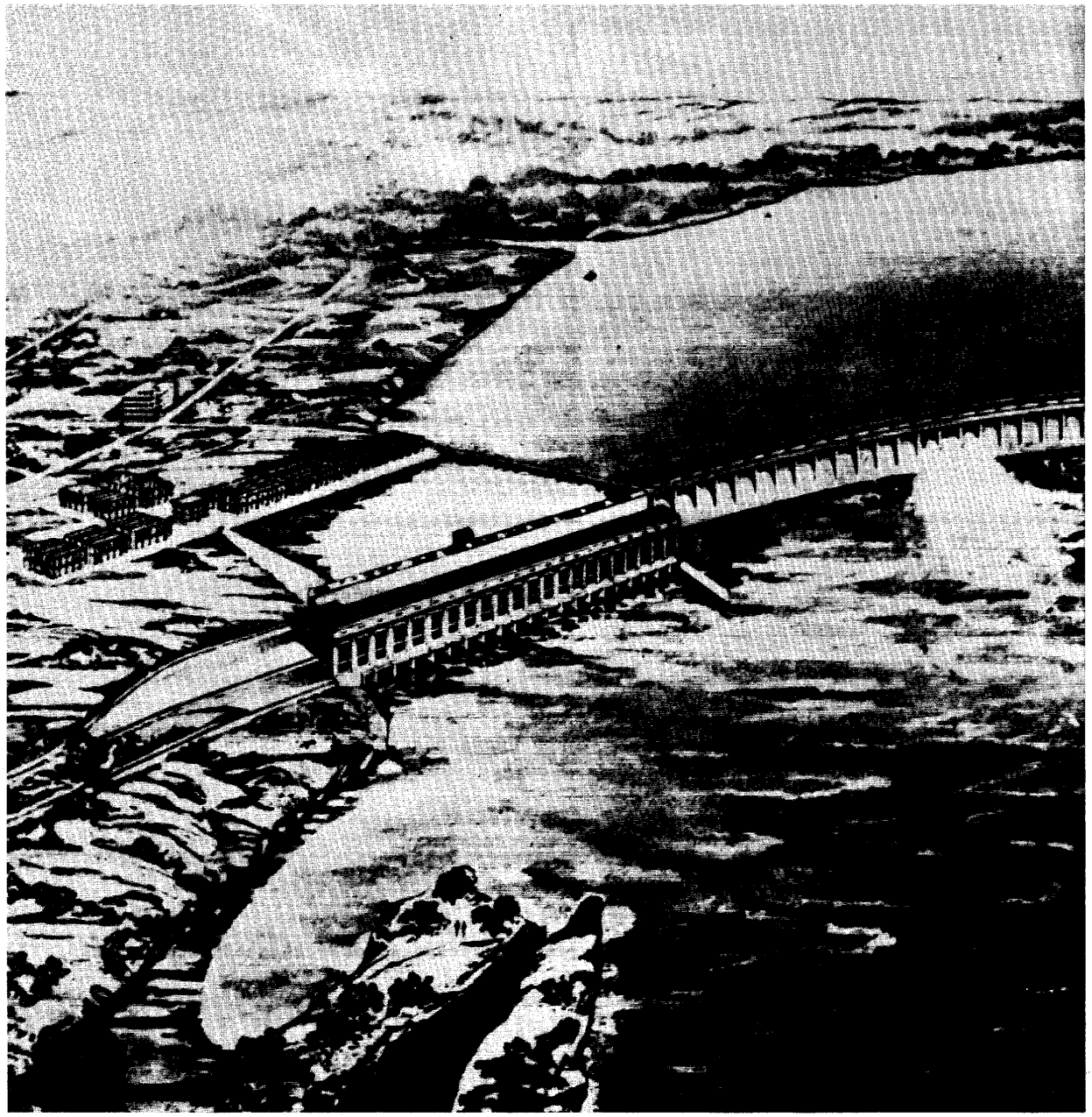


FIGURE IX-28. *Dnepr hydroelectric and navigation*

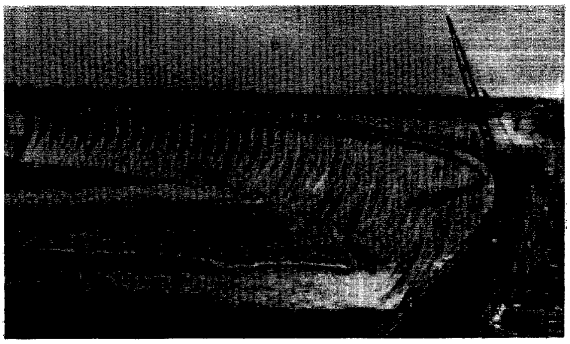
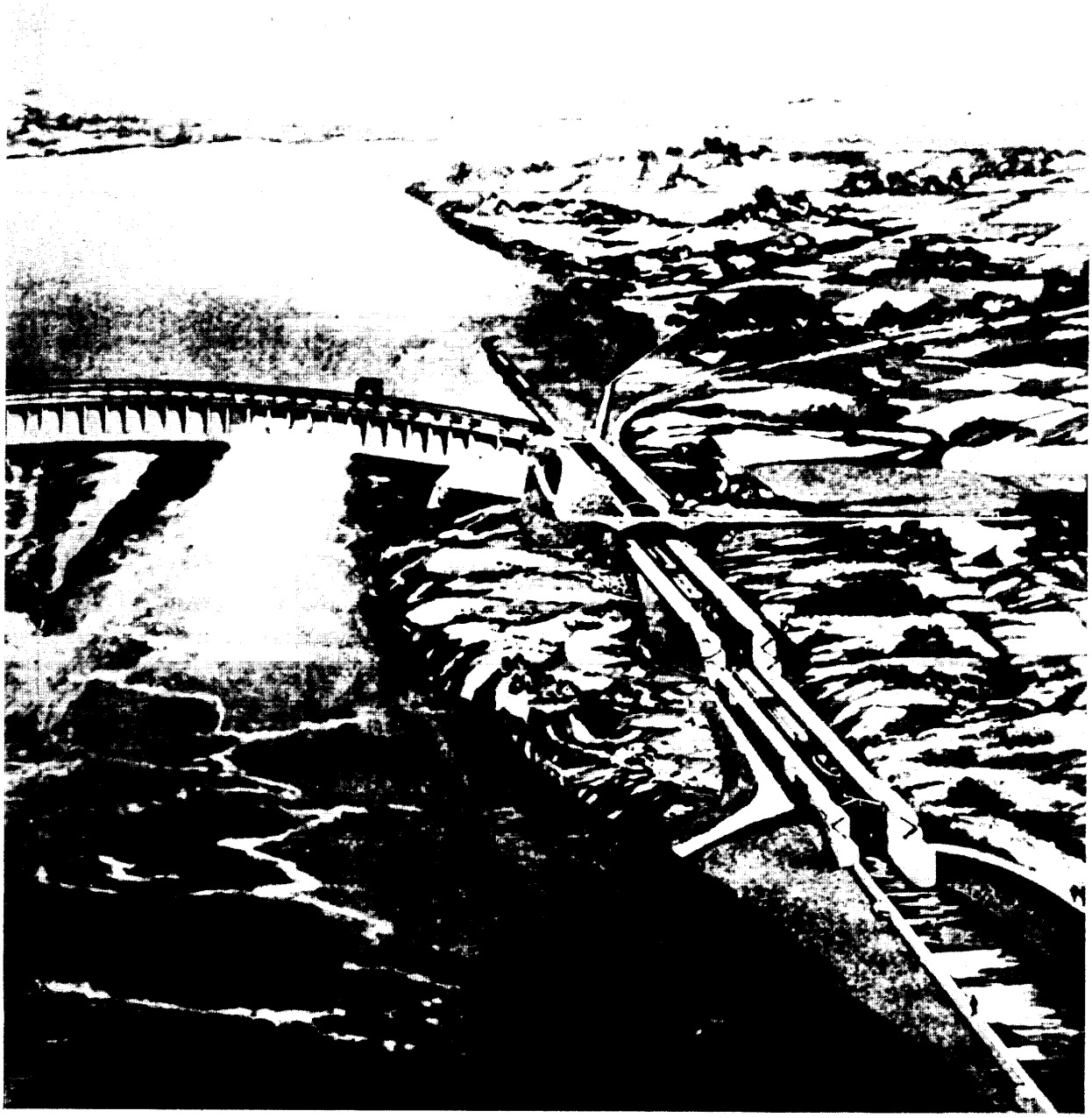


FIGURE IX-29. *Dnepr Dam, Dnepro-GES, looking west, 1946.*

production of only two grades of motor oil, with resultant loss of efficiency in many types of motors, and such limited sizes of semifabricated metal forms that metal fabricating plants all over the country must make special sizes out of standard sizes with an over-all loss to the economy. In 1945 a total of only 197 types and sizes of machine tools was produced in the Soviet Union. During the first quarter of 1946 alone 144 new types were introduced. For the year 1947 development of 1,300 new types of machine tools was scheduled, and of these 260 were due to enter production. The Soviets have developed business machines and computers, larger turbines than any produced before in Europe, complicated textile machinery, and radically advanced enriched-blast metallurgical equipment; technological progress is evident.



project, looking north. Drawing made about 1930.

(6) Labor

Prior to World War II the Soviet industrial labor force (excluding agricultural workers) reached a figure of 30 - 31 million persons. Military mobilization and temporary loss of territory subsequently caused a heavy drain upon it but, due to the added impetus given to recruiting new personnel, the net decrease suffered during the war was probably not greater than 10 percent. Because of demobilization and national increases the force available in 1947 is expected to reach a total of approximately 31,-600,000 persons. Under the fourth Five-Year Plan a goal of 33,500,000 workers has been set for 1950. Since European USSR has the greatest degree of industrialization as well as the largest population of any comparable area within the Soviet Union its proportion of industrial labor will probably be approximately 50 to 60 percent. In addition to the regular labor force there is a supplementary group of an estimated 15 million political prisoners who are assigned to the most arduous tasks. A relatively small percentage of these are employed within the limits of the European zone, chiefly in the far north and the Ukraine. Finally, there is an unknown number of foreign workers, including impressed civilians and prisoners of war.

The rapid advent of Soviet women into industry, which was already manifested before World War II, went on at a still faster pace after the outbreak of hostilities. From a proportion of 40% of the total labor force in 1941, the number of women in industry leaped to a maximum of 60% during the war. Demobilization and reconversion

have reversed the trend, temporarily, so that the proportion of women in industry at the end of 1946 probably was between 50 and 55 percent. In the European zone the ratio of women workers is judged to be one to two percent higher. Children are normally introduced into industry at a very early age, resulting in lowering the age of the average industrial worker.

The training of industrial labor in the Soviet Union is centered in the Ministry of Labor Reserves, which has set up two types of schools for this purpose. Railroad and trade schools provide the students with two years of specialized instruction; while the industrial training schools (FZO) give courses covering a six months period. While the training offered ostensibly is a voluntary proposition, in actuality most of the students are drafted or coerced into matriculation, and subsequently are placed at the disposal of industry for a period of apprenticeship. During the 1946-1950 period it is planned to train in these schools 4,500,000 new workers, of which the largest number will go to the ferrous metallurgy, mining, machine-building, transportation, and construction industries. In order to fulfill this program the number of schools (estimated to be about 2,800 in January 1947) will be increased to 6,000 by 1950. In addition to the above schools other ministries have their own institutions for instruction. Further facilities are available by means of "on the job" training at factories. Programs have been worked out for the retraining of old workers as well as the indoctrination of new recruits. Finally, about 1,900,000 engineers and technicians will be trained in higher institutions under the current plan. Despite the increase in training facilities, a marked shortage in skilled workers still persists.

Other expedients have been adopted by the Soviet government to improve the efficiency and productivity of labor. A system of quotas or "norms" was installed, with bonuses for overproduction to inspire labor to greater effort. Plans for 1947 include the wider application of the system in industry, and a general scaling upward of "norms" already in effect. A second device which has been used is the "Labor Book" system for controlling the movement of the worker. Each worker was issued a book in which was recorded his past working record and other pertinent data. The system bogged down during the war because of the tremendous demands of industry, but since the termination of the war agitation has developed for its greater enforcement. Another method which has been employed is through rationing. By penalizing nonworkers and those engaged in unproductive work, new industrial personnel have been acquired. The Soviet government likewise has made use of the trade-unions to spur on the workers by forcing them to assume greater obligations in carrying out programs at individual plants. Despite all this prodding the Soviet worker remains low in efficiency.

Notwithstanding the huge labor pool available to the Soviet Union all industries are afflicted with a chronic shortage. Low efficiency, lack of mechanization, and poor management cause plants to be grossly overstaffed as compared with American standards. Normally poor efficiency has been further lowered by the after-effects of the war. While these difficulties will continue to hamper the expansion of industry and delay the attainment of its final goals, they are not expected to prove insurmountable obstacles.

(7) Trend

The trend of new industrial development in the USSR was eastward during the third Five-Year Plan. Industrial centers far from frontiers were sought and obtained. With the commencement of hostilities with Germany, there began an unprecedented evacuation of armaments, machine building, and chemical plants particularly, and as much general industry as could be moved, into the Volga Valley, eastward to the Urals, and beyond. In many cases better and more available sources of raw material were found than had been available in the west, and adequate labor accompanied the plant. Rather than return to their original sites, many Soviet establishments have remained in their new locations. Their places are being taken by new factories, often constructed with the aid of machinery and materials seized in occupied territory.

The eastward trend has not ceased, but it has been integrated into an outward movement of industry from the Urals. The principal answer of the Soviet Union to the threat of the atomic bomb, at least initially, is dispersal of industry. As many regions of the USSR as have the requisite natural resources are being developed into regions of economic self-sufficiency. The Newly Incorporated Territories, those lands added to the Soviet Union in 1939 and 1940 by conquest, are receiving the highest per capita rate of investment under the current Five-Year Plan of part of the USSR. In European USSR, the attempt is being made to provide economic autarchy for the West, the South, the Central Industrial Region, the North, and the Volga Region. Each could furnish a balanced output to the nation if neighboring regions were destroyed in war.

(8) Underground

In World War II the Soviet Union started to place certain critical industry underground. Production, as well as storage, of munitions was included in this program to a considerable extent. Other underground installations included petroleum storage, and aircraft production and hangar facilities. Underground production in Germany proved invulnerable to conventional bombing attack and greatly strengthened the German war effort. Atomic bombing presents a greatly expanded threat to surface installations. Therefore great Soviet interest must be expected in underground construction. Evidence of this is seen in removal by the Soviet Union of German underground factories, complete with blowers and air-conditioning units. Many factors favor an extensive underground program for Soviet war industry. Extensive limestone karst formations, ideal for tunneling, fit this industrial pattern of the Soviet Union well. Underground construction would lessen demand for scarce construction materials, especially steel, and thus facilitate, rather than retard, reconstruction.

An underground program in preparation for another war would probably include some or all of each of the following industries:

1. Abrasives
2. Aircraft
3. Atomic energy
4. Ball bearings
5. Liquid oxygen
6. Machine tools
7. Missiles
8. Nitrogen fixation
9. Oxygen
10. Petroleum
11. Radio tubes
12. Submarine parts
13. Synthetic rubber
14. Tanks
15. Weapons

Within the current Five-Year Plan (1946-50) a Soviet underground program could be carried which would replace plants in the above categories which were destroyed during the War. This is especially applicable to industries which could be placed underground at a saving in construction materials and costs. Within three Five-Year Plan periods (1946-1960) a very thorough-going under-

ground program could be completed. Within this longer period such current problems could be solved as lack of transportation, equipment, materials, technicians, and labor.

B. Manufacturing plants and products

(1) Mineral processing

(a) Ferrous metallurgy (FIGURE IX-63).—The cake, iron, and steel industries are so closely interrelated that they are considered together in this discussion.

1. GENERAL LOCATION.—Krivoy Rog, in the Ukraine, has long been one of the leading centers of iron mining in the USSR, and until the Five-Year Plan period, the Donets Basin was almost the only steel area in the country. The twelve-year period from 1928 to 1940 was marked by the addition of large plants in the Urals and Western Siberia. With the loss of the Donbass to the Germans in World War II, these became all-important. Complete restoration of the devastated Ukraine is planned for the end of 1950, and at that time the Donbass will again be the major metallurgical base of the USSR. It enjoys an ideal combination of advantages: 1) rich iron deposits of a quality comparable to Lake Superior ores, 2) coking coal in thick veins, 3) manganese deposits, 4) abundant limestone, and 5) hydroelectric power within easy reach. Iron ore from Krivoy Rog is shipped 200 miles east to blast furnaces in the Donets coal area, at Makeyevka, Stalino, Yenakievo, Voroshilovsk, Konstantinovka, Kramatorsk, and Krasnyy Sulin. Coal is also carried west to the ore mines at Krivoy Rog, as well as to furnaces enroute at Zaporozh'ye and Dnepropetrovsk in order to fill trains returning for iron ore. East of the Donets coal fields there are steel mills at Stalingrad. In addition to this east - west movement, Donets coal is shipped south to Mariupol' on the Sea of Azov, where it meets iron ore from Kerch' in eastern Crimea. There are also blast furnaces at Kerch'. Additional iron discoveries at Kursk, 200 miles north of the Donets coal region, are claimed by the Soviets.

Before World War II, Leningrad was the leading city of the Soviet Union in machine building and metalworking, and received its raw materials chiefly from the south. It is now getting coal from Vorkuta, above the Arctic Circle, and the basin of the river Pechora. Attempts are being made to develop sources of iron ore in the Kursk area and on the Kola Peninsula. South of Moscow, pig iron and steel are produced on a modest scale at Lipetsk and Tula, and to the east are steel plants at Kulebaki and Vyksa. Moscow also has two steel plants with open-hearth furnaces, largely fed by scrap.

Electric steel is of great significance; about one million tons were produced annually before the war, chiefly in European USSR. A large quantity of electric power is required for its production: in the cold charge process the consumption of electric energy amounts to 700 to 900 kw.-hr. per ton of steel; in the fluid charge process, power consumption averages 200 to 300 kw.-hr. per ton. Accordingly, the largest electric steel producing enterprises are located near large power plants. The Noginsk Electrostal is near the largest peat-operated power plant in the country, the Klasson plant in the Moscow area. The Zaporozhstal, which belongs to the Dnepr combine, is near the largest hydroelectric power plant in the USSR, the Dneproges.

The central area for iron and steel production in the European part of the USSR including the Central Industrial, South, and Volga districts, depends to a considerable degree upon reclaimed metal. The highly developed machine-building industry of the area furnishes much waste metal and large quantities of old iron in the form of used machines, machine parts, trucks, rails, etc. In this area, steel and rolled iron production exceeds pig iron production.

Blast furnace plants are concentrated in two areas; in Tula, (Tula O.) with its remodeled Kozogorsk plant and the new Novotula plant, and in Lipetsk (Veronezhskaya O.), with its modernized Zvebodny Zokol plant and the new Novolipetsk plant. Cast iron is the primary product of these plants. The specialization of blast furnace plants in this area is based on the cast iron requirement of the adjacent regions (for automobile motors, pipes, radiators, etc.) and the properties of the basic raw material (the proportion of silicon and aluminum oxide in the ore). Most of the metallurgical plants connected with machine factories are in Leningrad, Moscow, Kolomna, Gor'kiy, Yenakiyevo, Stalingrad, etc.

2. PRODUCTION (FIGURE IX-30).—Current production estimates for coke, iron, and steel, in the area studied, are based upon incomplete data as to the rate of restoration in the Donbass. The Soviet government anticipates that prewar levels will be gained by the end of the fourth Five-Year Plan. Due to the expansion of ferrous metallurgy in the east and in the Caucasus, however, the former preeminence of the Ukraine in iron and steel production will not be regained. Estimates for European USSR for 1947 and 1950 are contrasted in the ferrous-metallurgy tabulation with estimates for the Soviet Union as a whole.

	1947			1950		
	EUROPEAN USSR	USSR	PERCENT OF USSR	EUROPEAN USSR	USSR	PERCENT OF USSR
	Millions of tons		*Percent*	*Millions of tons*		*Percent*
Coke	6.7	11.0	61	14.2	23.7	60
Pig iron	6.2	10.2	61	11.7	19.5	60
Steel*	8.9	16.4	54	15.5	25.4	60

* Including production from scrap.

The high ratio of steel to pig iron in these figures is due to careful use of steel scrap in Soviet manufacture.

Soviet pig iron production will show a marked increase if the Kapitsa enriched-blast process fulfills Soviet hopes and is introduced on a large scale. Essentially, this method consists of introducing liquid oxygen into blast furnaces instead of air, to increase through-put. It has been introduced experimentally at the Novo-Tulski plant in Tula Oblast'. Installations of the proposed type differ radically from existing equipment, and conversion of the industry would be expensive. Restoration of the southern plants, however, undoubtedly will be done on the basis of improving the former technical equipment.

Plans have been announced to reorganize the Azovstal plant at Mariupol' (Stalinskaya O.) so that it will have a full production cycle. When current additions are completed Azovstal will be the largest plant in the south, as Zaporozhstal was before the war. The second largest will be the Dzerzhinski plant (Dnepropetrovskaya O.) where the blast furnace will receive more powerful equipment. In addition, three new open-hearth furnaces will be built and new rolling mills are being installed. The construction of three new open-hearth furnaces at the Makayevka plant (Stalinskaya O.) will make it possible to utilize better than before the war the rolling mill capacity of the plant and will increase the output of metal. The open-hearth and rolling mill shops of the Voroshilovsk (Voroshilorgradskaya O.) factory will be completely rebuilt, as will a number of smaller plants.

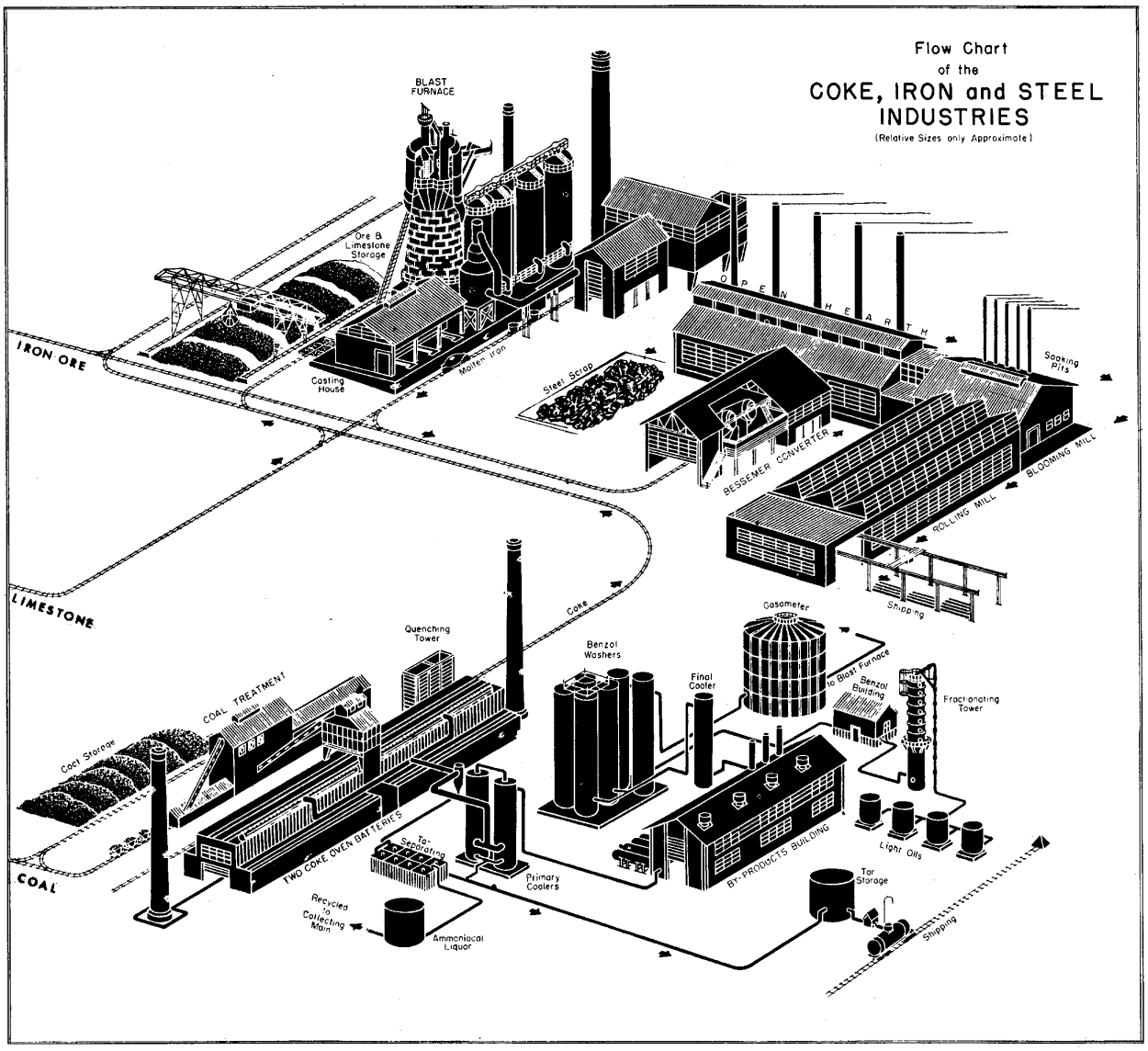


FIGURE IX-30. *Flow chart of the coke, iron, and steel industries.*

During the current Five-Year Plan the first sections of two new coke-chemical plants will be brought into operation in the South and the coke-chemical plant serving the factories in the Mariupol' region will be expanded.

Prior to the third Five-Year Plan only 25% scrap iron was used in open-hearth production of steel. That Plan announced that the amount of scrap iron used would be increased to at least 35 to 40 percent.

After the loss of the iron-producing and iron products industries in the South, which should have contributed about 40% of the total scrap iron quota for the country, it may be assumed that in 1942 about seven million tons of scrap were utilized. Accumulation and use of scrap iron certainly increased in 1943, because of: 1) the rise in steel production; 2) a stricter organization in scrap collecting; and 3) the awarding of priority to the shipment of scrap. It may be assumed that in 1943 about nine million tons of scrap were used in the iron and steel industries, which would have caused the proportion of scrap iron to increase to 45%, or 16 million tons. In 1944, stricter organizational measures to effect a complete collection and rapid forwarding of the scrap stocks warrant an increase in estimates for that year. Conversion in 1945 and 1946 has made available sharply increased tonnages of scrap metal from Army sources (largely in European USSR), and seizures in occupied territory have pushed the supply up further.

Data on rolled steel production in the Soviet Union appearing in the press during the first half of 1946 were similar to those on steel—a few comprehensive but incomplete figures, and various items on particular facilities.

Production of 17.8 million tons is planned for 1950, as against 13.1 million tons in 1940. The South should turn out 39% of the total, or 6.9 million tons. The percentage of output of Ministry of Ferrous Metallurgy plants contributed by eastern areas should be 51% and this percentage should be quite close for total output, indicating about 9.1 million tons to be produced in the East in 1950.

No published figures give a basis for determining 1945 production definitely. Perhaps the closest approximation to an estimate can be obtained from considering ratios of

ingot steel to rolled steel output. The latter was about 72% of the former in 1940, is planned for 68% in 1950, and if 12 to 13 million tons of raw steel were produced in 1945, probably 8.5 to 9.0 million tons of rolled steel were turned out.

In the current five-year period 104 rolling mills, with capacity of 11.7 million tons of rolled steel, should be put in operation.

Reconstruction was summarized by a statement made in February 1946 that 39 rolling mills had been restored out of 248 destroyed. Approximately 30% of the destroyed capacity was restored by early 1946. Twenty-one rolling and pipe mills went into operation in the East during the war, and 28 rolling mills are planned for installation there during the current five-year period.

In the South, the Makeevka plant has six rolling mills installed, of which one went into operation during 1945; three more are expected in 1946, as well as a blooming mill, and by 1950 production of rolled metal should be 30% above 1940. The Stalin plant should produce three to four times the amount of rolled steel in 1950 as in 1940; and the Dneprodzerzhinsk plant output should rise 83% in the same period through the addition of two rolling mills. At Zaporozhe, six large new mills are scheduled for the next five years. The Krasny Oktyabr plant at Stalingrad should be producing 25% more rolled steel than in 1941.

3. CHIEF PRODUCTS.—Productive capacity of coke, pig iron, and steel is broken down by oblasts within Soviet Economic Regions in TABLE IX-48.

TABLE IX - 48

CURRENT PRODUCTIVE CAPACITY OF COKE, PIG IRON, AND STEEL BY OBLASTS, EUROPEAN USSR
(Thousands of tons per year)

	Coke	Pig iron	Steel
North:			
Karelo-Finnish SSR	....	....	....
Leningradskaya O.	300	....	250
Vologdskaya O.	...	....	....
West:			
Latvian SSR	....	....	100
South:			
Krymskaya O.	300	200	100
Dnepropetrovskaya O.	1, 758	1, 200	1, 250
Kiyevskaya O.	....	....	50
Nikolayevskaya O.	....	....	50
Odesskaya O.	....	....	100
Stalinskaya O.	3, 463	2, 275	1, 300
Voroshilovgradskaya O.	770	100	50
Zaporozhskaya O.	85	100	60
Southeast:			
Rostovskaya O.	....	100	490
Central Industrial:			
Gor'kovskaya O.	....	180	1, 695
Kirovskaya O.	....	425	162
Moskovskaya O.	....	....	967
Orlovskaya O.	....	....	100
Tul'skaya O.	....	550	300
Voronezhskaya O.	....	200	600
Tatar ASSR	....	100	
Volga:			
Stalingradskaya O.	....	750	1, 300
Total	6, 676	6, 180	8, 924

4. TYPICAL INSTALLATIONS (FIGURES IX-31 to IX-35).—Soviet plants producing iron and steel and primary finished products are generally similar in structure and lay-out to those of other major industrial nations.

By-product ovens of modern design are used to produce most Soviet coke.

It is common to find electrical generating plants near blast furnaces for converting some of the blast furnace gas into electricity. Low-grade ores may be concentrated by several methods, including, in the USSR, hand sorting or "cobbing" with hand hammers. Most Soviet steel is made in open-hearth furnaces of the Siemens-Martin type. Bessemer converters producing special types of steel may be housed in open-hearth buildings or in their own structures. A number of Soviet metallurgical combines integrate their operations beyond the open-hearth stage, incorporating finishing mills which produce structural shapes, rails, sheet, wire, pipe, etc.

5. SPECIAL PROBLEMS.—Damage done to Soviet ferrous metallurgy by the German invaders during World War II was so extensive that it will not be repaired before 1950 at the earliest. In 1940, 69% of Soviet blast furnaces, 54% of steel furnaces, and 66% of coke batteries were in areas which later the Germans overran. Plants wrecked or partially destroyed had a total of 62 pig iron blast furnaces, 43 open-hearth steel furnaces, and 4,740 coke ovens with an annual capacity of 19 million tons of coke. According to official Soviet figures, 37 iron and steel plants were destroyed either partially or completely. These employed 168,000 workers and produced annually 11 million tons of pig iron, 10 million tons of steel and 8 million tons of rolled metal.

Some rolling mill equipment was evacuated to the east by the Soviets, along with a limited quantity of furnace blowers, valves, hoists, motors, and auxiliary equipment. The iron and steel plants and coke ovens themselves could not be removed, but the Germans were able to use only one open-hearth furnace. They produced no iron in the USSR. The major portion of the labor force remained in German-occupied territory, and gives an additional advantage to this region for the producion of iron and steel. Most of the wrecked plants were of modern construction or had been rebuilt during the first three Five-Year Plans. Most of the local workers have engaged in factory construction before. At present, lack of heavy construction machinery and supervisory personnel is delaying reconstruction in the South.

Wartime iron and steel requirements in the USSR were little larger than those of the Soviet planned economy in time of peace; productive capacity is taxed all the time. Qualitatively, however, war requires great quantities of steel with high manganese content for armor plate. This

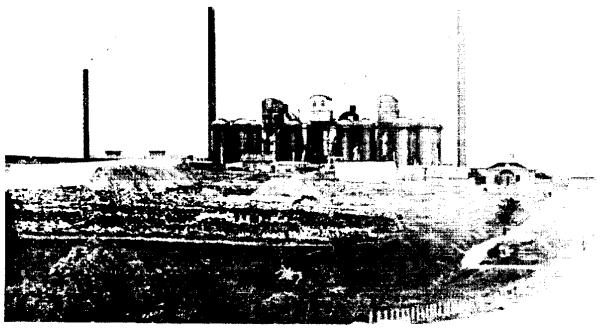


FIGURE IX-31. *Blast furnaces, near Moscow, 1943.*

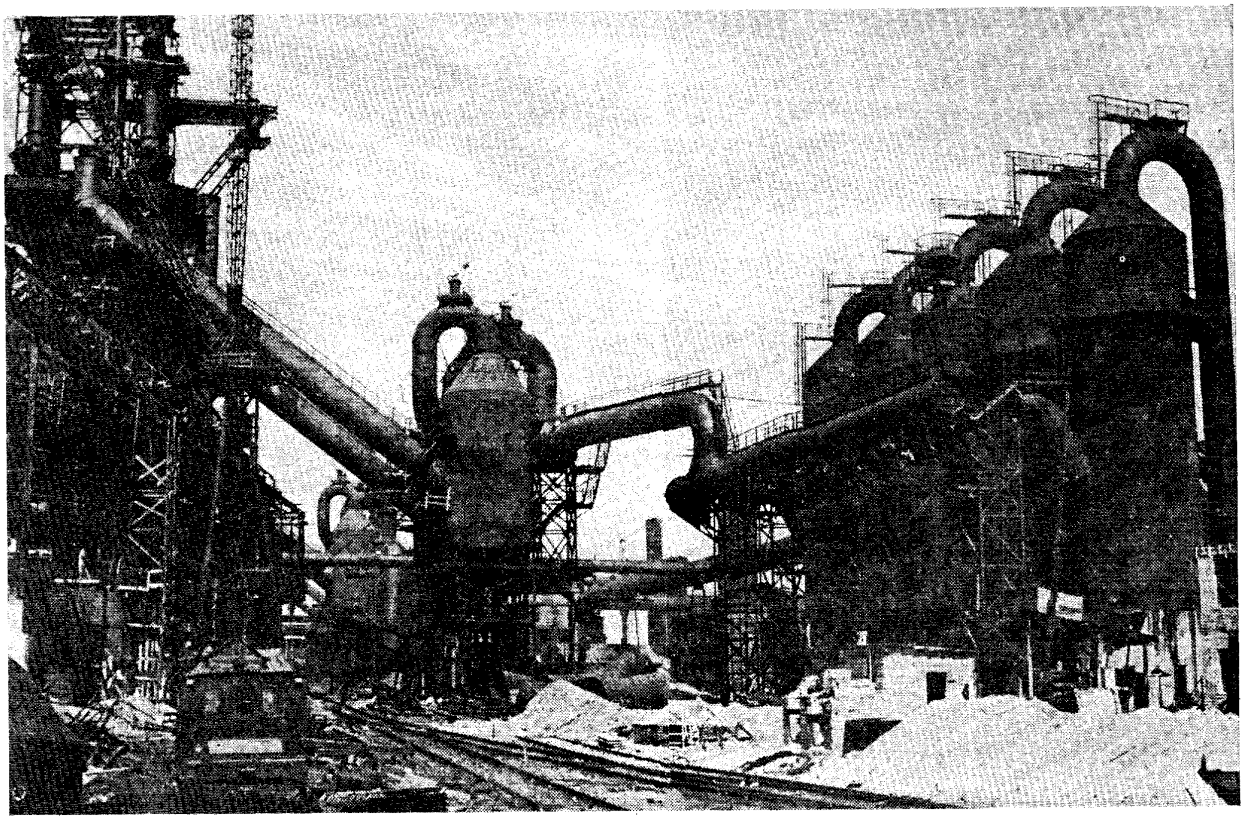


FIGURE IX-32. *Blast furnaces, Azov, 1939.*

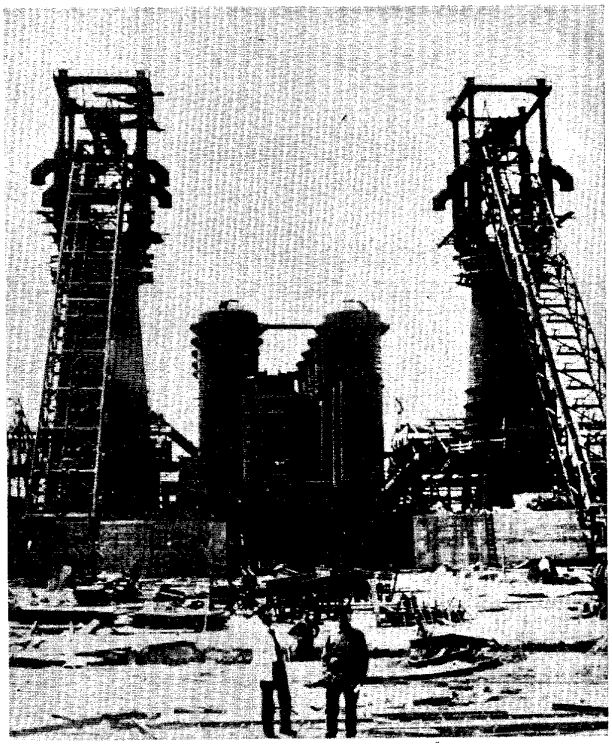


FIGURE IX-33. *Blast furnaces under construction, Kerch', 1931.*

was supplied in adequate quantities by Soviet ferrous metallurgy.

The Soviet iron and steel industry is even more concentrated than that of the United States in its huge aggregates and combines. Ferrous metallurgical enterprises of the Dnepr Bend, the Donbass, Moscow, and Leningrad play an important part in the war economy of the Soviet Union. Loss of the German-occupied zone obliged the USSR to expand production in the East, and to import over one million tons of steel and steel products from the United States under lend-lease agreements, during World War II. However, increasing emphasis is being placed upon the decentralization of industry in the USSR.

(b) Ferro-alloys

1. GENERAL LOCATION (FIGURE IX-36).—Much of the Soviet output of manganese, nickel, and vanadium is produced in European USSR. The area is dependent upon other parts of the country for chrome, tungsten, molybdenum, cobalt, and silicon. Tungsten and molybdenum production of the Soviet Union is insufficient for the country's needs. Imports enter through the ports of European USSR.

The steel-making industry which utilizes these alloy metals is largely centered in the Dnepr Bend and the Donets Basin areas in the south, and in the Moscow and Leningrad areas. In some cases the alloying metals are reduced from their ores near the mines and shipped as metals themselves to the steel centers. In other cases there are reasons necessitating transportation of the ore, either in bulk or in the form of concentrates.

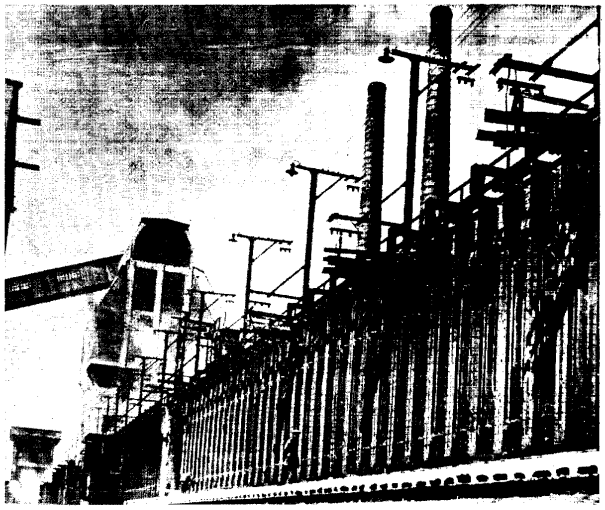


FIGURE IX-34. *Battery of coke-producing ovens, near Moscow, 1932.*

Nikopol' in the heart of the Dnepr Bend ferrous metallurgical industry, has one of the largest Soviet manganese deposits. Reserves are estimated at 75 million tons. It also enjoys proximity to the Dnepr Hydroelectric Station, the Dnepro-GES, a source of cheap power. Nikopol' ores are concentrated near the mines. Ferromanganese is produced by a blast-furnace process similar to the production of pig iron. However, a far lower yield of metal is obtained and coke consumption, ton for ton, is higher, due to the greater temperatures employed.

After manganese, the most important steel-producing alloy is ferrosilicon. This is an electric furnace product requiring large amounts of current (6,000 to 17,000 kw.) per ton of alloy. The main Soviet plant for the preparation of this ferro-alloy is located at Chelyabinsk in the Urals. Production facilities existed in the Ukraine before World War II at Zaporozh'ye, near the Dnepro-GES.

For the production of ferrochrome from chromite, charcoal, quartz, and calcium are required, together with 4,500 to 7,000 kw.-hr. per ton of alloy. The USSR is richly endowed with chromium ores. They are chiefly found in

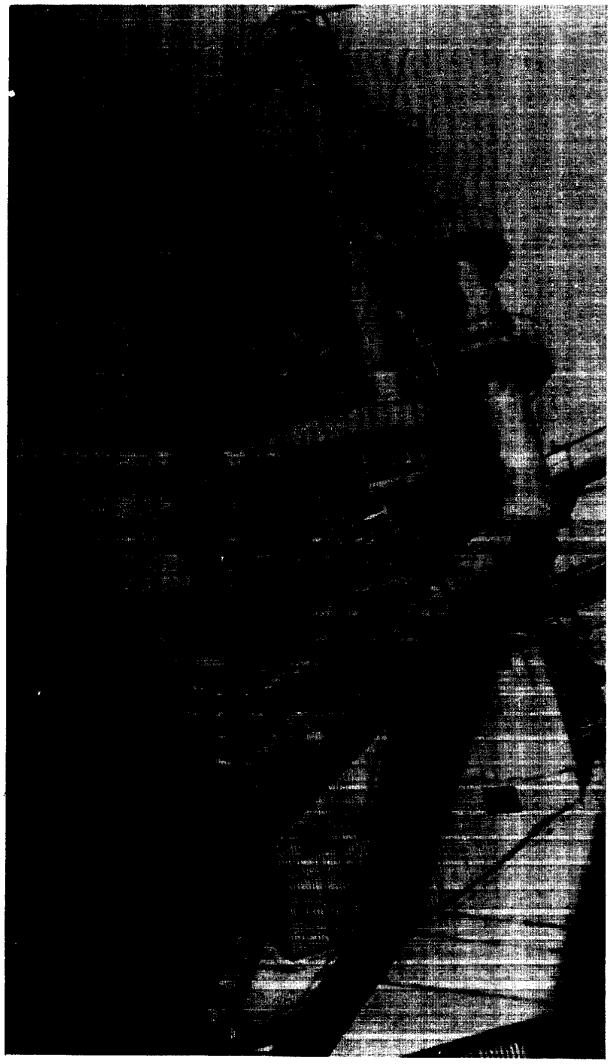


FIGURE IX-35. *Blast furnace No. 8, Dzerzhinski Steel Mill Dnepropetrovsk. 1937 or earlier.*

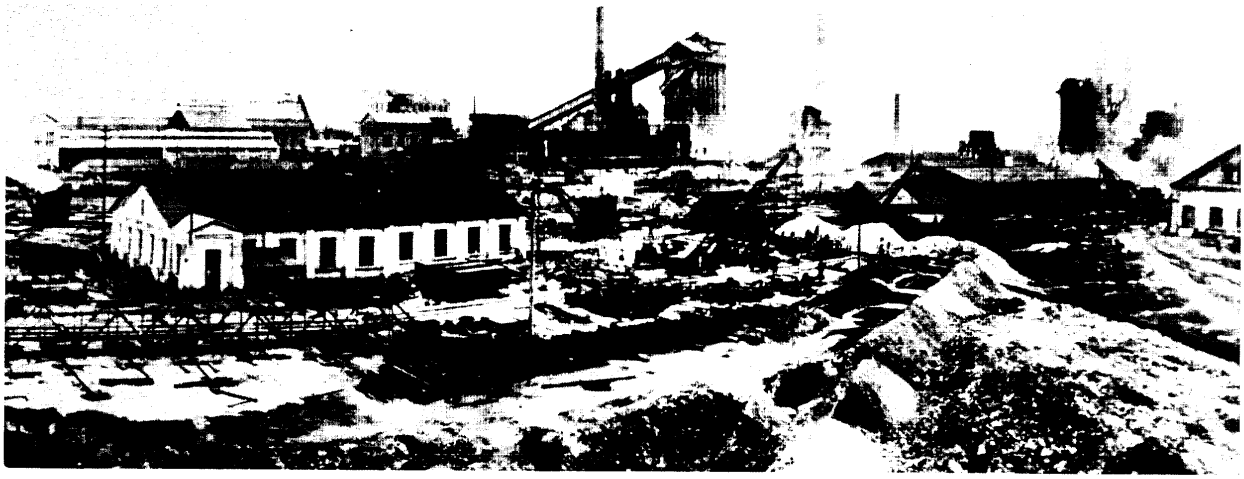


FIGURE IX-36. *Metal works, Kerch'. About 1943.*

the Urals, where the ferrochrome industry is centered, and in Kazakhstan. In European USSR, Zaporozh'ye was equipped to produce this alloy.

Tungsten and molybdenum ores are treated at or near the minehead, and concentrates are shipped to ferroalloy plants. Chief electric-furnace plants for producing ferrotungsten, an ingredient of high-speed steel, are in the Urals: Siberia and Eastern Siberia also produce this alloy. Principal ferromolybdenum plants are in eastern Siberia, Kazkhstan, and north Caucasus. It is assumed that ores mined at Vudyar in the Khibiny area (Murmanskaya Oblast') are melted at Zaporozh'ye, although plants in the Leningrad or Moscow area may be equipped to do the work.

Vanadium production is centered at Kerch', near titaniferrous magnetite deposits.

Nickel smelters are near minehead concentration plants at Pechenga and Monchegorsk (Murmanskaya Oblast'), but the most important deposits of the USSR are in Siberia.

2. PRODUCTION.—Production of ferro-alloys by oblast is given in TABLE IX-49.

TABLE IX-49

FERROALLOYS PRODUCTION BY OBLAST

Economic region and oblast	Place	Product	Estimated percent of USSR production (1946)
North:			
Murmansk	Monchegorsk	Cobalt	10
		Nickel	5
	Pechenga	Nickel	10
Vologda	Cherepovets	Nickel-Steel	0
South:			
Crimea	Kerch'	Ferrovanadium	0
Dnepropetrovsk	Nikopol'	Ferromanganese	0
Zaporozh'ye	Zaporozh'ye	Ferrosilicon	
		Ferrochrome	Not in production.
		Ferrotungsten	
		Ferromolybdenum	
Central Industrial:			
Moscow	Moscow	Ferrotungsten	5

(c) Light metals

1. GENERAL LOCATION OF INDUSTRY.—Production of ingot aluminum by electrolysis requires an abundant supply of cheap electric power. The power requirements vie with the location of ores in dictating the location of reduction works. The production of one ton of aluminum requires 20,000 kw.-hr. of electric power and two tons of alumina (aluminum oxide).

Aluminum ores other than bauxite and other substances from which the metal may be extracted, include nepheline, alunite, leucite, lignite ashes, and blast-furnace slag. Experiments have also been made at the Dnepr plant on the problem of obtaining alumina from kaolinitic clays, of which there are an estimated 32 million tons in the Ukraine. Interest in these materials has been lessened by recent discoveries of high-grade bauxite deposits in the Urals.

The electrolytic production of aluminum from processed raw materials requires carbon electrodes and cryolite (a sodium-aluminum fluoride mineral). Carbon electrodes have been manufactured since the middle of 1934 at Kudinovo, near Moscow. The Dnepr Aluminum Combine produced an estimated 50,000 tons of electrodes before the War. Cryolite is not found in the natural state in the USSR, but was produced artificially at the Dnepr plant and in the Urals.

Prior to the Revolution, Russia produced no aluminum. In 1932, during the first Five-Year Plan, the Soviets initiated the production of aluminum at the Volkhov plant (Boksitogorsk, Leningradskaya Oblast'). This plant used Tikhvin ores from the same region and was supplied with power by the Volkhov hydroelectric station.

The Dnepr aluminum plant (Zaporozh'ye, Dnepropetrovskaya Oblast') was completed in 1934 after the erection of the great Dnepr Dam power station. The plant operated on bauxite ore from Tikhvin, approximately 1,000 miles away.

During the third Five-Year Plan a plant at Kandalaksha (Murmanskaya Oblast'), on the Ikoa Peninsula, utilized the newly mined aluminum raw material nepheline, produced during the processing of Khibin apatites. Hydroelectric power from the Niva stations was used.

The location of the aluminum reclamation industry is not known fully, but is believed to follow the distribution of large industrial concentrations. During the war, more than a third of the aluminum produced came from reprocessed waste. The new Five-Year Plan envisages the building of two large scrap metal plants, one in the Moskovskaya Oblast', the other at Khar'kov. Scrap aluminum is being processed at Odessa and should also be processed at Stalino soon. Smaller plants are under construction for the salvaging of waste nonferrous metals at Kalinin, Voronezh, and Gor'kiy. Salvage operations are being decentralized to cut down transportation costs and help satisfy the requirements of local nonferrous industry.

Soviet production of magnesium dates from 1936 when, following operation of a pilot plant in Leningrad, one production center was established in the Urals and a second at Zaporozh'ye. It is believed that this plant utilized magnesite or dolomite ores.

2. PRODUCTION.—From 1942 to 1945 the production of aluminum and magnesium primary metal in European USSR was at or near zero. The Volkhov aluminum plant produced its first postwar aluminum in September 1946. The electrode factory is operating at the Dnepr plant. When rebuilt, the aluminum and magnesium plants of European USSR may be expected to have a combined capacity 10% to 15% higher than in 1940. In that year, European USSR produced 53,000 tons of aluminum, or 68% of the total USSR production of 78,000 tons, and 3,600 tons of magnesium, or 54% of the total USSR production of 6,700 tons.

The Soviet Union reclaimed an estimated 18,000 tons of aluminum in 1940 and is presumed to have maintained that level of metal recovery throughout the war.

Since the Germans destroyed all significant aluminum and magnesium production facilities in European USSR and as yet restored production is negligible, a view of prewar production is given in TABLE IX-50.

3. TYPICAL INSTALLATION.—The manufacture of aluminum from bauxite involves two distinct steps: 1) separation of alumina from the ore; and 2) reduction of aluminum from the aluminum oxide.

In the production of alumina, crushed ore is calcined in rotary kilns, and in the Bayer process this concentrate is then treated with caustic soda. The resultant aluminum

TABLE IX - 50

PRODUCTION OF ALUMINUM AND MAGNESIUM, 1940
(Thousands of tons)

Region and oblast	Plant	Alumina	Aluminum	Magnesium
Northwest:				
Karelo-Finnish SSR	Belomorsk	..	1	..
Leningradskaya O.	Boksitogorsk (Volkhovski Im. S.M. Kirov)	20	13	..
Murmanskaya O.	Kandalaksha	50	1	..
South:				
Dnepropetrovskaya O.	Zaporozh'ye (Dnepr)	32	37	3.6
Southeast:				
Rostovskaya O.	Rostov-na-Donu Proposed			
Central Industrial:				
Moskovskaya O.	Stalinogorsk	?	?	..
Yaroslavskaya O.	Scherbakov Under construction	..	..	..
Total	....	102	52	3.6

hydrate is calcined in a rotary kiln at approximately 1,300 degrees Centigrade to form alumina. Reduction of alumina to aluminum is performed by electricity in a series of reduction cells, each producing about 250 lb. of aluminum per day. This is effected in a bath of molten cryolite by the use of carbon anodes.

In 1938 the Dnepr aluminum plant at Zaporozh'ye had 480 electrolytic cells in a large building, with which an electrode shop was integrated. A separate plant to utilize blast-furnace slag for the production of alumina and various byproducts formed another part of the combine.

4. SPECIAL PROBLEMS.—The German occupation affected aluminum and magnesium production more vitally than any of the other metallurgical industries.

The Tikhvin plant and mines were captured by the Germans in the early part of 1941, and the Dnepr, Volkhov, and Kandalaksha plants were partially evacuated in that year. Only small-sized electrical equipment could be evacuated from the Dnepr plant, as it had been bombed and set on fire by the Germans. With these plants out of operation, over half of Soviet production was lost. Complete restoration of the Volkhov and Dnepr plants by 1950 is an aim of the fourth Five-Year Plan.

Tikhvin bauxite has proven unsatisfactory in the past, due to its high silica content. At the Volkhov plant, some alumina was received from the Tikhvin alumina plant, as the Volkhov plant had larger facilities for aluminum production than its alumina output could meet. Additional treatment required by the Tikhvin ore and other factors, including construction expenditures and exorbitant haulage rates have brought the production cost of Volkhov aluminum to about two and one-half times the world market price. By 1939, preparations were under way to adapt the Volkhov plant to the use of nepheline.

Volkhov ores have also led to unsatisfactory operation at the Dnepr plant. The planned output for 1939 was fulfilled to the extent of only about 75%, and during 1940 there were periods when the plant operated at only 50% of capacity due to shortage of bauxite.

The demand for aluminum in the USSR is virtually unlimited. In the past, very limited use of light metal has been permitted outside the defense industries. Manufacture of transportation equipment, including aircraft, trucks, tanks, and railroad equipment provides the greatest demand. Guided missiles manufacture is a large potential use for aluminum. The electrical, chemical, abrasives, and prepared food industries require aluminum. The thermite process for separating the metals from their oxides by utilizing the affinity of aluminum for oxygen has cheapened the process of manufacturing pure chromium, manganese, vanadium, tungsten, molybdenum, and rarer metals. Aluminum unites easily with certain other metals to form strong, light alloys.

Substitution of magnesium and other metals for aluminum, and of plastics for metals is receiving much attention in the USSR, as elsewhere.

(d) Other nonferrous metallurgy

1. COPPER.—There are no furnaces in European USSR for smelting copper ore. In the reduction of nickel at Monchegorsk, on the Kola Peninsula, copper is extracted as a byproduct. This absence of smelters can be explained by the fact that copper plants are located in the immediate vicinity of deposits, since the ores have a relatively small copper content and it is inexpedient to transport unproductive rock over great distances. The main copper deposits of the USSR are in the Urals and in Kazakhstan. There has been little development of the ores known to exist on Novaya Zemlya, in the Barents Sea.

The fact that the chief prewar consumers of copper were concentrated in the central and northern regions led to localization of the secondary (scrap) copper and semifabricating industries in those parts of the country. During the war, about half of all the copper produced came from reprocessed waste. There was a large copper plant named after Molotov in Moscow. Small plants, such as those at Davydovo, Golitsyno, Krupino, and Salkovo in Moskovskaya Oblast', need little more equipment than a cupola furnace, crushing and baling machines, and electromagnetic separators. Copper scrap was also processed at Leningrad, Kolchugin (Izmail'skaya Oblast') and in Kiev. The current Five-Year Plan envisages the building of a large scrap metal factory in Moskovskaya Oblast' and smaller ones at Kalinin, Voronezh, and Gor'kiy. Decentralization of salvaged metal plants will cut down transportation costs.

2. ZINC AND LEAD.—Zinc and lead usually occur together as a mixed ore. The relatively small metal content of the ores and the inexpediency of transporting unproductive rock over long distances require that the location of smelters be in the immediate vicinity of the deposits. It is more expedient to transport finished metal to the main zinc and lead consumption areas.

The production of zinc and lead requires considerable fuel and electric power and cheap labor. Zinc electrolysis in particular requires much electric power. It does not follow that the production of zinc and lead must take place where there is an abundant production of fuel and electric power. Fuel and even water power resources are distributed more evenly over the country than are the nonferrous metals, and it is usually possible for a combine in the mixed ore industry to obtain power resources of its own. However, availability of large power resources seems to have kept in operation the only zinc smelter known in European USSR at Konstantinovka (Stalinskaya Oblast') in the Ukraine after depletion of the nearby Nagolny deposits. This smelter was destroyed by the Germans, but is believed to have been restored in part. In 1937 this plant was

credited with a production of 11,220 tons, or 16.5% of a USSR total of 68,000 tons. Ore for this plant could be obtained from Kazakh SSR or North Ossetian ASSR or from the Urals, although information from German sources states that prewar operations were conducted solely on the basis of zinc concentrates from the Far East and from the Altayskiy Kray in Western Siberia. No lead smelting is known in European USSR and the extent to which reclaimed zinc and lead is produced cannot be determined.

3. TIN.—One small tin smelter operates in Moscow on Siberian ore. Otherwise there is no smelting of this metal within European USSR. There is no appreciable mining either, although small deposits are reported to occur on the Kola Peninsula (Murmanskaya Oblast'). Production of secondary metal is confined to reclamation processing plants at Dnepropetrovsk, Kiev, Podolsk (Moskovskaya Oblast'), and Leningrad. The first two of these four plants were destroyed by the Germans, but are believed to have been restored in part. The 1940 scrap tin output did not exceed 550 tons, or 25% of an estimated total tin output for the USSR of 2,200 tons.

(2) Machine building (FIGURE IX-64)

(a) General.—In the USSR there are All-Union Ministries of: 1) Heavy Machine Building; 2) Machine and Apparatus Building; 3) Transport Machine Building; 4) Agricultural Machine Building; 5) Road and Construction Machine Building; 6) Automotive Industry; and 7) Machine Tool Building. In this section machinery manufacture will be discussed under these headings, except that "heavy machine building" will be discussed under "mining and metallurgical machinery" and "power machinery." Other machinery will be discussed as "medium machine building," except for separate treatment of machine tool manufacture. Location of industry and production will be considered together in this Section.

Before the Revolution, Russia was predominantly an agricultural country, and machine building was extremely backward. Railroad and agricultural machinery building was better developed than other types, but even here did not meet the minimum requirements of the economy. At the beginning of the third Five-Year Plan (1938), machine building had so developed that it represented 25.4% of the production value of Soviet industry, compared with 6.8% in prerevolutionary Russia. Production of power machines has been increased in relation to the value of total machinery output, as has general industrial equipment, and, although the building of transport machines has greatly increased, the share of the latter in total machine building has decreased since 1928.

Before the Revolution, the machine-building industry was very unevenly distributed throughout Russia. More than 50% of it was located within the relatively small area of the old industrial region of Moscow, Leningrad, and the adjoining districts. Seventy-five percent of the power plant equipment was produced here, 50% of locomotive construction, and 97% of electrical engineering equipment. Only the production of agricultural equipment was located in other districts of the country, particularly in the south.

Since 1941 major changes have taken place in the locations of the machine-building industry. It was expanded rapidly in the old industrial areas and was established simultaneously in the Ukraine, the Urals, and the Volga area. Individual centers of this industry were formed in the Transcaucasus, in Central Asia, West and East Siberia, and the Far East (TABLE IX-51).

TABLE IX - 51

MACHINE BUILDING PRODUCTION AND LOCATION BY OBLAST

Location	Number of plants	Remarks
MINING AND METALLURGICAL MACHINERY		
North:		
RSFSR:		
Leningradskaya O.....	2	30-ton hoists; coke exhausters; blowers.
South:		
Ukranian SSR:		
Dnepropetrovskaya O....	2	Centrifugal pumps; metallurgical equipment; mining equipment.
Kiyevskaya O.....	1	Mining and metallurgical machinery.
Stalinskaya O.....	5	Electric borers; compressors and pumps; rubble machines of all kinds; mine elevators; blooming mills; machinery for the oil industry; boring installations (geological); coal, iron and steel mining equipment, including hoists, etc.; metallurgical equipment.
HEAVY—MINING AND METALLURGICAL MACHINERY		
Volga:		
RSFSR:		
Stalingradskaya O.....	1	Ore cutting machines.
Central Industrial:		
RSFSR:		
Gor'kovskaya O.....	2	Petroleum pumps; mining machinery.
Ivanovskaya O.....	2	Cranes and hoists.
Kalininskaya O.....	1	Steel and iron foundry and machine factory and peat extracting machinery.
Kirovskaya O.....	1	Cranes and hoists.
Moskovskaya O.....	5	Slag crushers, grinders; trench digging machines; dredges; tunnelling machinery; equipment for metallurgical plants; mining hammers; equipment for oil and coal industries; refinery installations; bits.
Ryazanskaya O.....	1	Apparatus and equipment for mines.
Tul'skaya O.....	2	Repair of mining machinery, compressors, pumps, coal mining equipment.
Yaroslavskaya O.....	3	Dredgers; rams; hoists; mine cars, mine combine; scrapers; suction pumps; winches.
Vladimirskaya O.....	1	Leaders; pumps.
HEAVY POWER MACHINERY		
North:		
RSFSR:		
Leningradskaya O.....	7	Power plant equipment; spare parts; turbogenerators to 100,000 kw.; hydro-generators; electric motors; electric machine building; turbines; oxygen compressors; hydroturbines, 100,000 kw.; steam turbines, 102,000 kw.

TABLE IX - 51 (Continued)

Location	Number of plants	Remarks
South:		
Ukranian SSR:		
Dnepropetrovskaya O....	1	Boilers.
Khar'kovskaya O.....	2	Turbogenerators, 100,000 kw.; large electric motors; shafts for hydroturbines.
Southeast:		
RSFSR:		
Rostovskaya O.....	1	Boilers—largest in USSR.
Volga:		
RSFSR:		
Saratovskaya O.....	1	Diesel engines.
Central Industrial:		
RSFSR:		
Gor'kovskaya O.....	1	Transformers rebuilt.
Moskovskaya O.....	2	Electric locomotives; mobile power stations; transformers; turbines; electric equipment for iron industry.
Vladimirskaya O.....	1	Transformers; armatures.
Yaroslavskaya O.....	1	Dynamos.
MEDIUM MACHINERY—MACHINE AND APPARATUS BUILDING		
North:		
Karelo-Finnish SSR.....	1	Machinery and metals.
RSFSR:		
Arkhangel'skaya O.....	2	Machine building; gas generators.
Kurganskaya O.....	1	Polygraphic machines.
Leningradskaya O.....	32	Machine construction; textile and shoe machines; diving apparatus; hoists; spinning machines, silk and cotton; rubber gaskets, covers, packings, etc.; linotype; crane and hoist machinery; abrasive wheels; pressure equipment; melting furnaces; oil switches; blueprint machines; textile machine parts; metal works; minting machines; looms; pinions; winches; presses, pumps; elevators; ventilators; heating plants; special cars.
Murmanskaya O.....	3	Machine and metal works.
Pskovskaya O.....	1	Machine and metal works.
Vologodskaya O.....	2	Conveyors, winches, work benches, other products.
West:		
Estonian SSR.....	1	
Latvian SSR.....	2	Cranes; machine parts.
RSFSR:		
Gomel'skaya O.....	1	Pumps, winches, other products.
Minskaya O.....	1	Work benches, etc.
South:		
Ukranian SSR:		
Chernigovskaya O.....	1	Winches.
Dnepropetrovskaya O....	1	Belt drives.
Kaments-Podol'skaya O..	1	Planing benches.
Khar'kovskaya O.....	4	Machine factory; cable cranes; conveyor systems; ball bearings; iron construction.
Kiyevskaya O.....	3	Machines for chemical and pump compressor industries. Marine machine shop; cranes; calendering machines; industrial conveyors.
Kirovogradskaya O.....	1	Pumps; jacks.

TABLE IX - 51 (Continued)

Location	Number of plants	Remarks
RSFSR:		
Nikolayevskaya O.....	3	Hoisting equipment; industrial trucks; cisterns; metal constructions; conveyors; wheelbarrows; hoisting equipment.
Odesskaya O.....	7	Industrial trucks; pumps; cranes; conveyors; gripping devices; hoists; cisterns.
Stalinskaya O.....	3	Compressors and pumps; rollers; other products; structural steel.
Vinnitskaya O.....	1	Concrete; stone machines; winches.
Voroshilovgradskaya O...	2	Pumps; industrial trucks; separators; conveyors; trucks.
Zaporozhskaya O.....	4	Pumps; compressors; cisterns; punched pressed parts; machinery.
Zhitomirskaya O.....	4	Turntables; elevators; industrial trucks.
Southeast:		
RSFSR:		
Rostovskaya O.....	3	Engine repair shop; machinery; large machine building plants restored.
Volga:		
RSFSR:		
Astrakhanskaya O.....	2	Aircraft accessories; 35 hp. diesel engines; machinery.
Kuybyshevskaya O.....	6	Industrial filters; boilers; autoclaves; containers; compressors; ball and roller bearings; parts for portable engines; cranes.
Mordovian ASSR.....	1	Heating appliances.
Saratovskaya O.....	9	Containers; diesel engines, 45 and 60 hp., furnaces; centrifugal pumps; cranes; ball bearings; welding apparatus; electric stoves; gears.
Stalingradskaya O.....	4	Welded boiler drums; cranes; woodburning generators.
Tatar ASSR.....	5	Typewriter factory; conveyors; transport installations; soap; industrial machinery.
Ul'yanovskaya O.....	2	Machine fittings; ribbed pipe.
Central Industrial:		
RSFSR:		
Gor'kovskaya O.....	10	Nail springs; calibrated articles; machinery; wheelwright machines; diesel motors; sleds; trailers; industrial cars; paper machines; gears; metal casings; housings; metal containers; furnaces, stoves; crushers; pulverizers; edge runners.
Kirovskaya O.....	1	Cranes; hoists; snow ploughs.
Ivanovskaya O.....	18	Machinery and metals; washing machines; textile machinery; paper machinery; nonferrous strips; grills, etc.; hoists; cranes; stoves; cog wheels; reels; brick machines.
Kalininskaya O.....	1	Textile machinery.
Kirovskaya O.....	2	Cranes; hoists; fire-fighting equipment, sawmill machines.
Kostromskaya O.....	3	Metals and machinery.
Kurskaya O.....	1	Machinery factory.
Penzenskaya O.....	3	Boilers, welding apparatus; centrifuges.

TABLE IX - 51 (Continued)

Location	Number of plants	Remarks
MEDIUM MACHINERY—MACHINE AND APPARATUS BUILDING (Continued)		
Central Industrial		
RSFR: (Continued)		
Moskovskaya O	82	Metals and machinery; food processing machinery; textile machinery; grinders; crushers; millers; metal goods; platinum needle; pumps; fittings and ball bearings; electro machines; turbines; bakery equipment; cannery equipment; vacuum pumps; boilers; scales; compressors; radiators; screws; fuel drums; refrigerator equipment, jacks; conveyors; cable cars; cranes; hoists; airconditioning equipment; ventilator equipment; fire-fighting equipment; ventilators; heaters; plumbing equipment; fire engines, soap; rubber machinery; glass machinery; woodworking machines; typewriters; textile and leather machinery; wagon wheels; spinning machinery; machine construction; chemical industry equipment; grinders; condensers; locks; turntables; rachets; oxygen apparatus; parts for looms; transporter and conveyor equipment; textile and sewing machines; mine locomotives and trucks; refrigeration equipment; textile machine parts, fans; blowers; winches.
Ryazanskaya O	13	Machinery and metals; conveyors, winches; pumps.
Tambovskaya O	4	Typewriter parts; vulcanizing equipment; machine parts; nonferrous equipment; boilers; ball-bearings.
Tul'skaya O	15	Machinery and metals; machine parts; grain mill equipment; food processing machinery; industrial machinery.
Vladimirskaya O	5	Machinery and metals; industrial machinery; shafts; cogwheels.
Voronezhskaya O	2	Radiators, parts for central heating; crushers; mixers; rollers.
Yaroslavskaya O	9	Woodworking machines; machinery and metals; rubber, asphalt machines; elevators; textile machinery; diesel truck motors, 110 hp.
North:		
Karelo-Finnish SSR	3	Transportation equipment; motor repair parts.
RSFSR:		
Arkhangel'skaya O	4	Transportation repairs; motor vehicle repairs; tractor repairs.
Komi ASSR	3	Motor vehicle repairs.
Leningradskaya O	42	Tank pumps; tank repairs, parts; tires; combat vehicles; reconnaissance cars; motorcycles; parts for combat vehicles; brake bands; motor vehicle repairs; carburetor factory; storage batteries; tank turrets; combat vehicles; parts; tank engines; tank parts; tank plates; tank assembly; combat vehicle repair; new type of tank; tank motor repair; tank motors; tanks; motorized field kitchens; trucks; motor repair; truck trailers; truck, tractor repairs.
Murmanskaya O	1	Vehicle repair.
Vologodskaya O	2	Lumber trucks; vehicle repair.
West:		
White Russian SSR:		
Minskaya O	3	Diesel tractors; tractor factory planned for 1948 production; diesel 5–7 ton truck for 1948 production; bicycle plant under construction.
South:		
Ukranian SSR:		
Chernigovskaya O	1	Tractor parts.
Dnepropetrovskaya O	2	Auto plant, under construction; auto repair plant, under construction.
Khar'kovskaya O	7	Bicycles; tank repair; tank engine repair; motor vehicle repair; transport equipment.
Khersonskaya O	1	20 hp. "Locomotive Cars".
Kiyevskaya O	1	Motor vehicle repair.
Nikolayevskaya O	2	23 hp. motorcycles; tank parts; tractor parts.
Odesskaya O	1	Tank parts.
Rovenskaya O	1	Tank repair.
Stalinskaya O	5	Tractor parts; motor vehicle repair; tank repair; motor vehicle repair.
Voroshilovgradskaya O	1	Tractor repair.
Zaporozhskaya O	1	Auto engine parts.
Zhitomirskaya O	3	Tractor parts.
Southeast:		
RSFSR:		
Rostovskaya O	4	Engine repair shop; motor vehicle and tractor repair; tractor parts.
Volga:		
RSFSR:		
Astrakhanskaya O	3	Motor sleds; motor vehicle and tank repair.
Kuybyshevskaya O	4	Tractor repair, and motor vehicles; auto parts; tank parts.
Saratovskaya O	14	Motor vehicle repair; ambulances; tractor repair; tank repair; tractor parts; bogie wheels; tanks.
Tatar ASSR	2	Tanks; tractor parts.
Stalingradskaya O	5	Tanks; tank parts; tractor nuts, bolt and parts; tractor parts; motor vehicle repair.
Ul'yanovskaya O	2	Tractor parts; motor vehicle repair.

TABLE IX - 51 (Continued)

Location	Number of plants	Remarks
MEDIUM MACHINERY—MACHINE AND APPARATUS BUILDING (Continued)		
Central Industrial:		
RSFSR:		
Chuvash ASSR	1	Truck bodies.
Gor'kovskaya O	23	Tank plant; tractor parts; auto plant, tanks and parts of engines; tank manufacture and repair; motor sleds; motor vehicles, tractor parts; tank radiators; tank parts; tank gears; trailers; wheels; 1, 1.5, and 3 ton trucks, busses; ship and bridge building plant; semifinished; truck and prime mover factory; cylinders.
Ivanovskaya O	7	Tank repair; tank trucks; transportation equipment.
Kaluzhskaya O	1	20 hp. locomotive cars.
Kirovskaya O	6	Light tanks; tank parts; tank and tractor repair; starters, governors, etc.
Mari ASSR	....	Tank repair.
Moskovskaya O	50	Wood-gas operated motor vehicles; tank repair and assembly; cross-country vehicles; tank parts; tank motor parts; motor sleds; ambulances; motor-vehicle repair; truck repair; tank manufacture; radiators; general overhauling, armored cars; general car repair; brakes; motorcycles; parts; engine repair; auto chassis; motorcycle assembly plant; truck bodies; engine blocks for ZIS-150; motor vehicle accessories; tanks; bogie wheels; fan belts; motor vehicle radiators.
Penzenskaya O	3	Motor vehicle repair; munitions.
Ryazanskaya O	1	Tractor repair.
Smolenskaya O	2	Tank repair.
Tambovskaya O	3	Tractor engine repair; tank repair, motor vehicle repair; motor vehicle parts.
Tul'skaya O	1	Motor vehicle repairs.
Vladimirskaya O	3	Tank trucks.
Voronezhskaya O	3	Radiators; parts; tractor factory, under construction; motor vehicle repair.
Yaroslavskaya O	8	Tractor parts; motor vehicles and tractors; truck production 1946; tank starters; motor vehicle parts; motor vehicle brakes.
ROAD AND CONSTRUCTION MACHINERY		
North:		
RSFSR:		
Leningradskaya O	1	Pneumatic drills; compressed air motors; pick hammers.
West:		
White Russian SSR:		
Minskaya O	1	Stone crushers.
Latvian SSR	1	Railroad car factory, road construction machinery.
South:		
Dnepropetrovskaya O	2	Parts for construction industry.
Odesskaya O	3	Road construction machinery; concrete mixers and equipment for construction industry; single parts for construction industry.
Stalinskaya O	2	Construction industry.
Vinnitskaya O	1	Concrete mixers, stone crushers, winches.
Zhitomirskaya O	1	Elevators, winches, concrete mixers.
Central Industrial:		
RSFSR:		
Bryanskaya O	1	Transporters and heavy graders.
Moskovskaya O	3	Construction machinery; mechanical factory; compressors.
Yaroslavskaya O	1	Road rollers.
Volga:		
RSFSR:		
Saratovskaya O	1	Construction machinery.
MEDIUM MACHINERY—AGRICULTURAL EQUIPMENT—OTHER THAN TRACTORS		
North:		
Karelo-Finnish SSR	1	Agricultural machinery.
RSFSR:		
Leningradskaya O	....	Engineering equipment.
West:		
Estonian SSR	1	Agricultural machinery and parts.
White Russian SSR	1	Agricultural machinery.
South:		
Ukranian SSR:		
Dnepropetrovskaya O	1	Reapers.
Khar'kovskaya O	1	Threshing machines; farm machinery.
Kiyevskaya O	2	Small wind mills; incubators; parts for agricultural machinery.
Khersonskaya O	1	Agricultural equipment.
Kirovgradskaya O	1	Sowing and threshing machines; combines.
L'vovskaya O	1	Beet harvesters.
Odesskaya O	1	Agricultural equipment.
Stalinskaya O	1	Five-body plows.
Zaporozhskaya O	2	Agricultural machinery; reapers and binders.
Southeast:		
RSFSR:		
Krasnodarskiy Kray	3	Agricultural machinery; water tanks; pumps, small steam engines.
Rostovskaya O	2	Farm equipment; tractor ploughs; sheaf binders; combines; harvesters.
Volga:		
RSFSR:		
Kuybyshevskaya O	1	Heavy agricultural machinery.
Mordovian ASSR	1	Agricultural machinery.
Saratovskaya O	4	Farm machinery; combines; agricultural machinery parts.
Stalingradskaya O	2	Parts.
Tatar ASSR	1	Grain mills.

TABLE IX - 51 (Continued)

Location	Number of plants	Remarks
MEDIUM MACHINERY — AGRICULTURAL EQUIPMENT — OTHER THAN TRACTORS		
Central Industrial:		
RSFSR:		
Gor'kovskaya O.	3	Agricultural machines, flax sorters; equipment for corn mills; grain elevators.
Kalininskaya O.	2	Flax and potato machinery.
Moskovskaya O.	6	Agricultural equipment; parts for agricultural equipment in many factories; separators; grinders; repair of agricultural equipment; fans and blowers; harvesters.
Orlovskaya O.	1	Flax machine.
Ryazanskaya O.	1	Agricultural equipment.
Tambovskaya O.	1	Agricultural machine parts.
Tul'skaya O.	3	Agricultural machine parts; separators.
Vladimirskaya O.	1	Tractor cultivators.
Yaroslavskaya O.	1	Combined mowing and threshing machines.
MACHINE TOOLS		
North:		
RSFSR:		
Leningradskaya O.	19	Arc welding; electric drills; precision tools; lathes; turret lathes; grinding machines; tools; grinders; welding apparatus; drills; hammer tools; horizontal grinding machines; automatic lathes; machine tools; drill lathes; precision lathes; tooth-cutting machines; shaping machines; universal drills, vertical and horizontal; diamond drilling lathes; twisting machines; wire-drawing benches.
West:		
White Russian SSR.	3	Machine tools; milling machines; turning lathes; planing machines.
Lithuanian SSR.	1	Machine tools.
South:		
Ukrainian SSR:		
Dnepropetrovskaya O. . . .	1	Heavy machine tool works.
Khar'kovskaya O.	3	Machine tools; auto-thread-cutting machines; grinding machines; central planing machines.
Kiyevskaya O.	3	Machine tools.
Odesskaya O.	1	Machine tools.
Poltavskaya O.	3	Machine tools.
Stalinskaya O.	1	Turret lathes.
Voroshilovgradskaya O. . .	2	Tools.
Zaporozhskaya O.	1	Tools.
Zhitomirskaya O.	4	Armatures; lathes; machine tools, tools.
Southeast:		
RSFSR:		
Rostovskaya O.	4	Machine tools; universal lathes; machines.
Volga:		
RSFSR:		
Kuybyshevskaya O	5	Polishing lathes; machine tools; milling and drilling machines; combination machine tools; pressing and grinding machines; lathes; thread cutters; semi-automatic machines; turret lathes.
Mordovian ASSR.	1	Auto-machine tools.
Saratovskaya O.	9	Precision machine tools; lathes; milling machines; punches; cold presses; horizontal cutting machines; drilling, threading machines; machine tools; tools; cog-wheel cutting; grinding, milling, planing, drilling machines; welding apparatus; frontal turning machine tools.
Stalingradskaya O.	5	Mobile fitters shops; machine tools; die slotting machines; machine tool parts; planing machine.
Tatar ASSR.	4	Drilling machines; auto tools; heavy grinding, planing, milling machines; lathes; planers for non-ferrous metals; machine tools; iron saws; grinders; millers.
Central Industrial:		
RSFSR:		
Gor'kovskaya O.	10	Heavy machine tools; cog-wheel tooling machines; grinding, drilling, and milling machines; turret lathes; wheelwright machines; roll lathes; punch presses; lathes; chucks; devices and dies; vehicle tools; grinding tools.
Ivanovskaya O.	2	Machine tools for own use; calendars; lathes; universal grinders; steam hammers; lathe parts.
Kalininskaya O.	1	Fitters and assembly tools.
Kirovskaya O.	3	Drilling machines; files; grinding and milling machines.
Moskovskaya O.	25	Grinding, milling machines; textile machine factory; machine tools; work benches; machine accessories; platinum-needle plant; machine and tool parts; 6-shaft vertical lathes; universal lathes; oxygen-acetylene welding equipment; apprentice shops; twist drills; auto punch presses; gear milling machines; auto and semi-auto machine tools; worm cutters; planing machines; mass production machinery; cog-wheel milling machines; machine tools; electric drills; chiseling machines; punch press parts; turret lathes; gear cutting machines; precision tool equipment.
Penzenskaya O.	1	Semi-auto, auto-metal-cutting lathes.
Ryazanskaya O	1	Boring lathes; special machine tools.
Tambovskaya O.	1	Punch presses.
Tul'skaya O.	1	Milling machines; lathes.
Vladimirskaya O.	1	Milling, drilling and grinding machines; machine tools.
Voronezhskaya O.	1	Air hammers.
Yaroslavskaya O.	2	Machine tools.

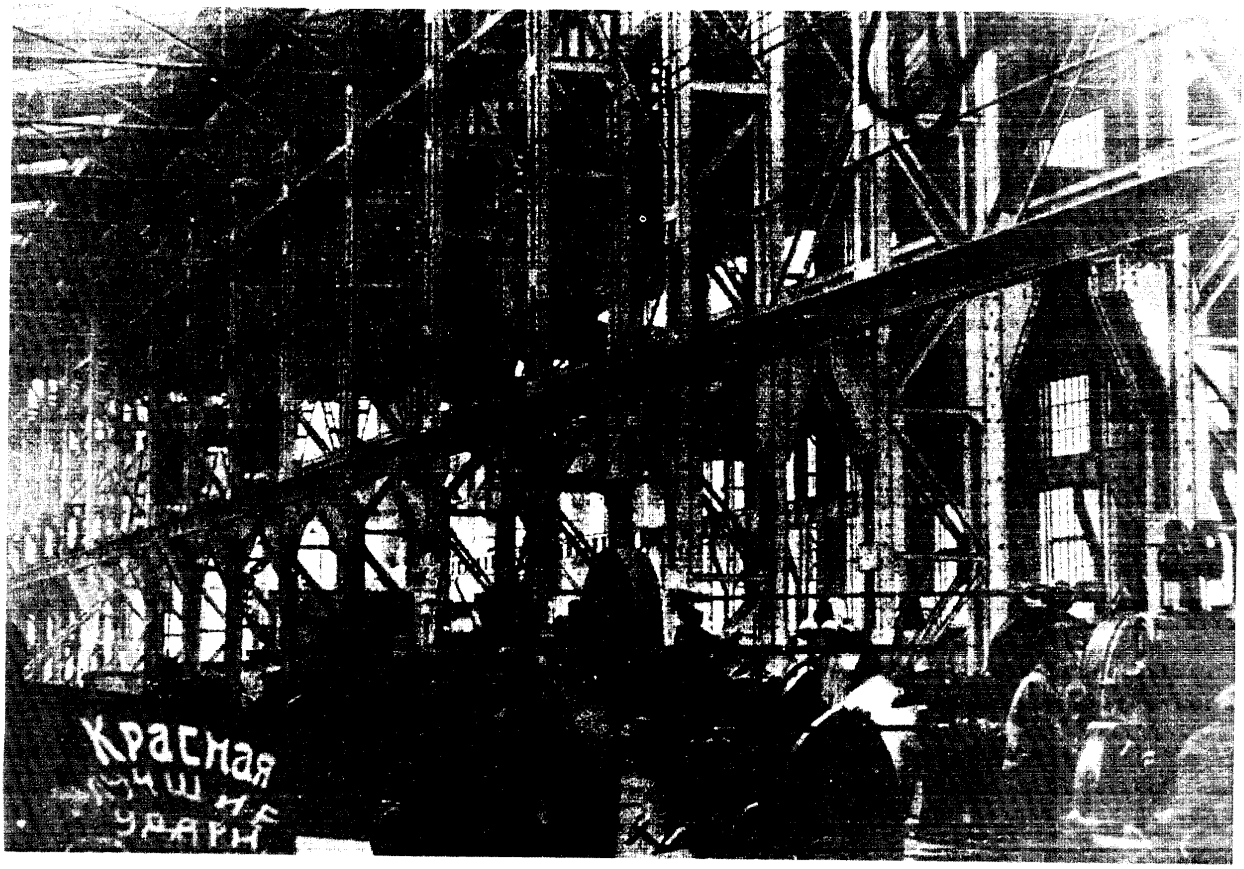


FIGURE IX-37. *Heavy machinery plant, Kramatorsky. 1931 or earlier.*

(b) Heavy machinery

1. MINING AND METALLURGICAL INDUSTRY.—This industry is located in those regions where there is a need for that type of machinery. Production of machinery for equipping smelting works and mining installations in nearly all countries is carried on where the smelting and hard coal industries are located. This proximity is necessary because of the large amount of metal used in this branch of machine construction, and difficulties in shipping its products (rolling mills, equipment for blast furnaces, etc.). Many Soviet plants producing metallurgical plant equipment were erected during the first Five-Year Plan; among these were the two great plants for heavy machine construction at Kramatorsk (Ukrainian SSR), and the Uralmashzavod plant (Sverdlovsk).

Before World War II, production of mining equipment, particularly for the hard coal industry, was distributed throughout the chief hard coal regions. The plants in the Don basin existed, prior to the Revolution as small shops, and were extensively enlarged during Five-Year Plans. Building of machinery for the petroleum and peat industries was carried on in regions where those industries exist. The most important manufacturing centers for petroleum production equipment were in the Caucasus, but peat machinery came from Ivanovo and Kalinin. The distance of these regions from the localities where iron is produced is offset by the fact that it is much easier to transport the iron than it is to transport the finished machinery. Due to the urgent requirement for speed in reconstruction of the USSR, the center of mining and metallurgical machine building in European USSR is currently in the old Moscow-Tula-Gor'kiy "industrial triangle."

Output of mining and metallurgical equipment in the USSR at present is believed to be above that of the prewar period; production in 1940 was 28,000 metric tons. It may be assumed that production in 1946 was at or near maximum prewar production. In the five years 1946-50, the USSR plans to produce a total of 405,000 tons of mining and metallurgical equipment or an average of over 80,000 tons a year. Production for 1946 is taken as 60,000 tons and for 1950 a projected 102,900 tons. While full restoration of the Donets basin is planned by 1950, the greatest mining and metallurgical centers are now in the Urals and Western Siberia. Long-range plans for the Kuznets and Angara basins make it unlikely that the mining and metallurgical equipment industry in European USSR will regain the relative importance it enjoyed before the war.

The move eastward was accelerated by World War II, but Leningrad, Moscow, and Khar'kov have kept their importance through the technical ability of their designers and workers and have regained much of their prewar importance in the industry.

2. POWER MACHINERY.—Power machine manufacture, one of the chief branches of the machine-building industry, includes steam boilers, steam engines, steam turbines, water turbines, motors, transformers, and other primary equipment for electrical power production.

In the production of power equipment more and more use is being made of special high-grade steels. Power machine manufacture, therefore, has developed chiefly in steel centers such as Leningrad and Moscow. The construction of new plants for the manufacture of power machines was also carried on during the first years of the Soviet regime in the old centers or in cities in the vicinity

of the old industrial centers. During the first and second Five-Year Plans power machine manufacture (FIGURE IX-37) also underwent development in other districts, particularly in the Ukraine and in the Volga district (Saratovskaya O.).

In order to carry out the very extensive program of electrification in the period 1946-50 the output of electric generating equipment will be very greatly increased. In 1950, for instance, the combined production of hydroelectric and steam turbines will total 3,928,000 kilowatts of installed capacity. This increase is very great — more than a third of total installed electric capacity of the USSR at the beginning of the war. It compares with a production of similar equipment in 1940 of 1,447,000 kw. of small hydroelectric turbines designed mainly for installation on collective farm electric power stations.

Wartime expansion of machine building in the Urals, notably at the Uralmashzavod in Sverdlovsk, has altered relative importance of the output in European USSR but has not threatened its lead. (See also Topic 96,C, Electrical Manufacturing.)

(c) Medium machinery.

1. MACHINE AND APPARATUS BUILDING.—As used in this section machine-building includes the manufacture of all machinery except that for the mining, metallurgical, and electric power industries. The principal products are stationary engines and motors. The term apparatus includes conveyors, winches, pumps, etc., together with ball and roller bearings, hand tools, cisterns and tanks. Since the chemical industry is connected with the coal and metallurgical industries, and was developed in the heavy industrial regions of the Ukraine, chemical machinery was made there also until the war; this industry is now centered in the Urals, with some production in Moscow. The main plants building textile machinery are located in the centers of the textile industry: Moscow, Leningrad, Ivanovo, Shuya (Ivanovskaya Oblast'), and others. Plants to produce equipment for the food industry are located in regions where the food industry is highly developed—in the central black earth regions (Voronezh, Kursk, Kiev, and Khar'kov) and the Crimea. With the destruction of nearly all these food machinery plants, machine-building factories in the Central Industrial region have taken over food machinery production until the restoration of these plants by the end of the fourth Five-Year Plan.

During the war this industry operated at about 80% of prewar levels. In 1945, due to the start of postwar reconversion, production fell to about 60% but prewar levels were regained in 1946, with strong recovery in machinery, chemical, textile, consumer goods industries, and in pumps and convertors. Building of new plants in the East is expected to balance restoration of war-damaged plants in European USSR, and it is unlikely that the prewar preeminence of the Central Industrial region will be regained.

2. VEHICLES.—The term vehicles, as here used, includes automobiles, tractors, tanks, motorcycles, bicycles, and mechanical parts.

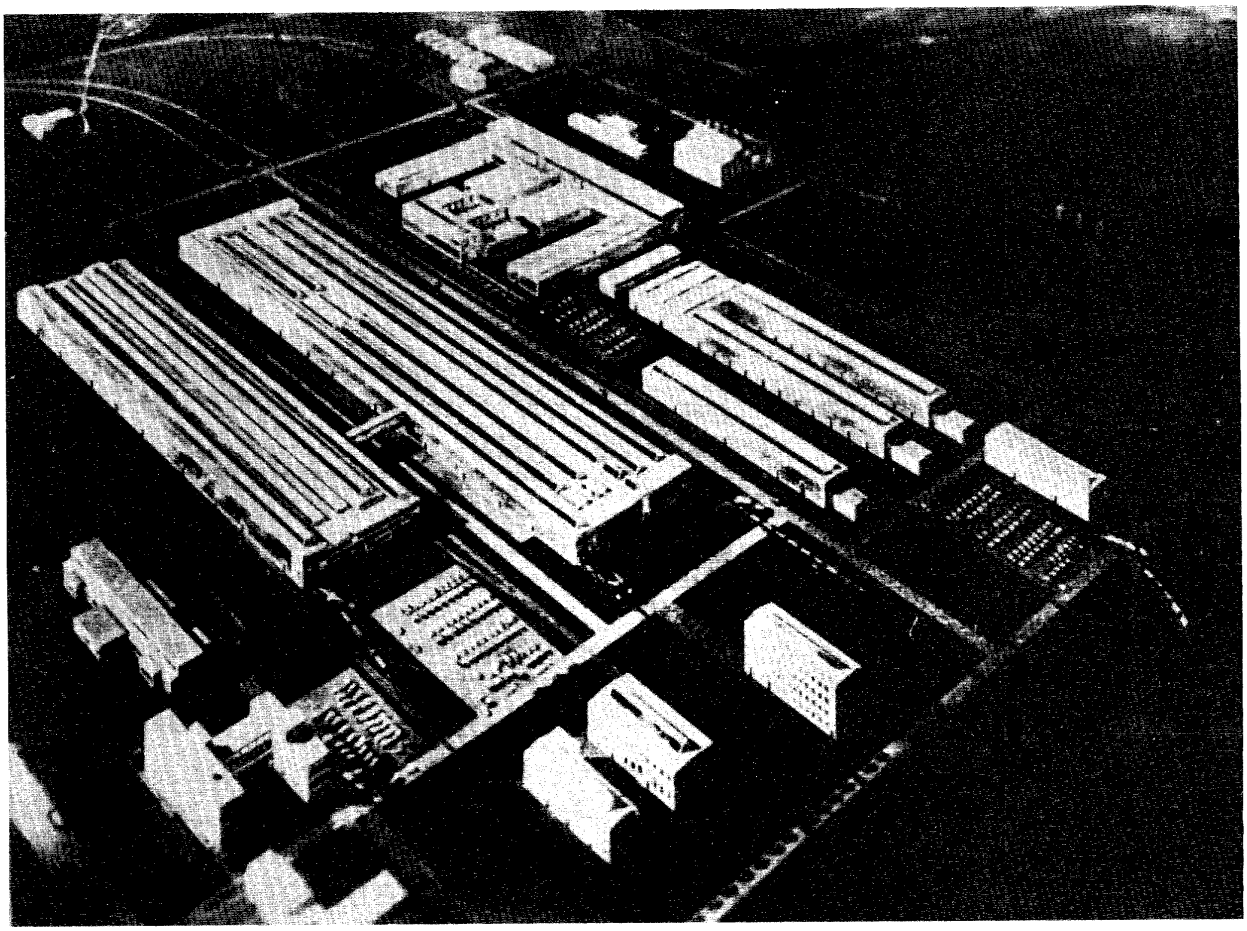


FIGURE IX-38. *Molotov Automobile Factory, looking west, Gor'kiy, 1931.*

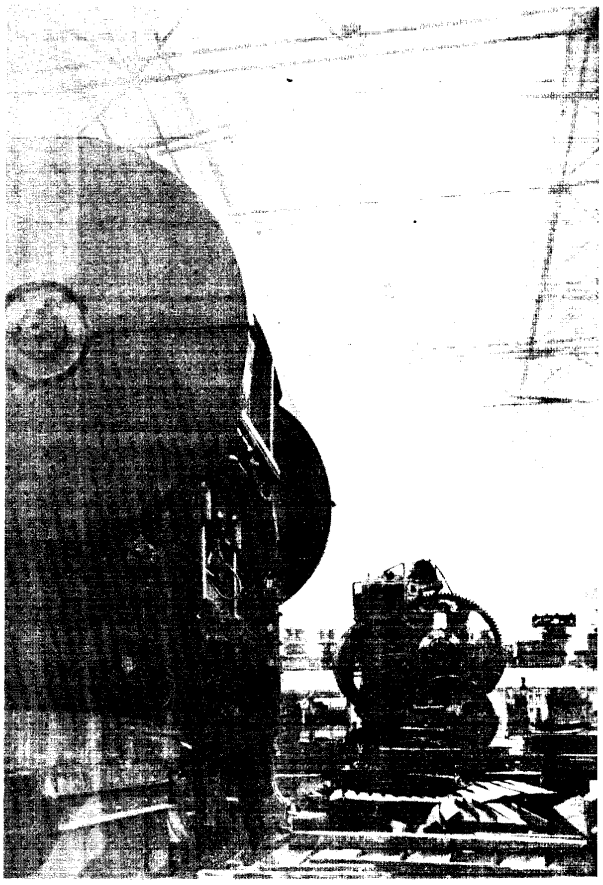


FIGURE IX-39. *Stamping shop, Molotov Automobile Works, Gor'kiy, 1936.*

a. Automobiles.—The manufacture of new automobiles began in 1923-1924, when the Moscow AMO (Akzionernoye Moskovskoye Obshchestvo) Plant completed ten vehicles. Up to 1928 1,400 vehicles were produced by these shops. The small plant in Yaroslavl' which was still operating at that time produced an additional 200 vehicles. Thus the total capacity of the automobile industry up to the first Five-Year Plan was concentrated in two small plants in Moscow and Yaroslavl'.

Under the first Five-Year Plan the automobile factory dedicated to Stalin was erected in Moscow to replace the old AMO. The plant was set up in the capital because there were various related machine factories in Moscow as well as trained experts and scientific laboratories for the development of the industry.

During the first Five-Year Plan the automobile factory in Yaroslavl' was remodeled and converted to the manufacture of five-ton trucks and busses. The city also became the center for manufacture of tires and tarpaulins. In the course of the Plan (1928-1932) the Soviet automobile industry produced 57,000 vehicles.

Toward the end of the first Five-Year Plan the new and more productive Molotov plant was built at Gor'kiy (FIGURES IX-38 and IX-39). This city was chosen because it had specialized in the construction of commercial carriers (locomotives, railway cars, and ships) and had a large number of specialists in this field. An important factor in the choice of this site was its location on the Volga, which made possible cheap procurement of raw materials and semifinished products (from Yaroslavl' and the Urals, on the Kama and the Volga, etc.). It also made possible cheap delivery of the automobile parts to other sections where assembly plants were erected.

During the second Five-Year Plan automobile production was increased almost tenfold with the erection of new plants in Gor'kiy and the expansion of the Stalin plant in Moscow.

Construction of automobile assembly plants was begun before the war; one was the KIM plant in Moscow; another was the very large assembly plant (for 40,000 units a year) at Rostov-na-Donu. During the war lend-lease vehicles were assembled at Gor'kiy, Moscow, and Ulyanovsk. During the years 1946-50 new automobile factories are projected at Dnepropetrovsk in the Ukraine, at Ulyanovsk (Ul'yanovskaya Oblast') on the Volga River, and at Minsk in Belorussia. In addition the KIM Plant in Moscow will be put back into operation and the Yaroslavl' Truck Plant considerably enlarged. The Gor'kiy Factory and the Moscow Stalin Works are to be reconverted and modernized.

A number of large auxiliary suppliers are connected with automotive plants. Just prior to the war 258 separate parts factories contributed to the Kaganovich plant, the most important contributor being the Stalin Auto Works in Moscow. A number of auxiliary plants have been set up in the Ivanovo area, which has a favorable geographical location between the three automobile production areas. These include the Automobile Accessories Plant in Vladimir (Vladimirskaya Oblast') which makes precision gages, oil pressure gages, windshield wipers, etc., and the plant in Kirs (Kirovskaya Oblast') which makes headlights and other parts. On the eve of the war the Yaroslavl' Auto Works was served by 112 other factories.

Approximately 90% of automotive vehicles produced in the USSR are trucks. It will be noticed in the tabulation of estimated automobile production that the percentage of passenger cars to total automobile production remains low, even in plans for 1950.

	1938		*1946*		*1950 (plan)*	
	European USSR	USSR	European USSR	USSR	European USSR	USSR
Trucks	184,400	184,400	126,650	139,600	338,000	428,000
Passengers cars and busses	26,800	26,800	400	400	65,600	65,600
Total	211,200	211,200	127,000	140,000	403,600	493,600 (Called 500,000)

b. Tractors.—During the first Five-Year Plan, two large tractor plants were built. One was the Dzerzhinski plant in Stalingrad and the other was the Ordzhanikidze tractor plant in Khar'kov. These plants first manufactured wheeled tractors, but later converted to the production of track-laying types. These plants are located in the center of the main agricultural regions, the Ukraine and the Volga; which have the largest demand for tractors and are close to the prime coal and metal sources.

The first tractors produced in the USSR were built in 1923. From that year until 1928, 3,800 tractors were built and 29,300 were imported from foreign countries. At that time, tractor construction was carried on chiefly at the Kirov plant in Leningrad, which manufactured Fordson type tractors. In addition, the locomotive plant in Khar'kov manufactured the "Kommunar" tractors.

The need for tractors is very great because of losses during the war and because of deterioration of the existing inventory of machines. Destruction of the Khar'kov and

Stalingrad plants during the war has set back Soviet production very seriously, as indicated by the tabulation of estimated tractor production, which also reflects a conversion to defense industry:

	European USSR	USSR
1937	60,000	78,800
1940	25,000	31,000
1946	7,000	14,800

c. Tanks.—Up to the beginning of World War II the Soviet Union did not have any factories exclusively for the manufacture of tanks, but the tractor plants at Khar'kov and Stalingrad as well as the Kirov armaments plant at Leningrad produced tanks in peacetime.

The first few months of the war showed that large-scale conversion to tank and self-propelled gun production in plants of the tractor and automobile industry must have been planned early. After the loss of Khar'kov and evacuation of Leningrad and Stalingrad, tank production in European USSR was concentrated in the Gor'kiy and Kirov areas. The factories in Khar'kov, Stalingrad, and Leningrad were again put in operation as large repair shops with the advance of the Red Army. The Soviets have made repeated claims that tank and self-propelled-gun manufacture was resumed in those factories before the end of the war, but these claims have not been verified. Estimated average annual tank production in 1942-45 was:

	European USSR	USSR
Tanks	4,000	18,000
Self-propelled guns	2,000	8,000
Armored cars	4,000	4,000
Total	10,000	30,000

Manufacture of tanks and self-propelled guns continues in time of peace. Of an annual production for the USSR estimated at 10,000 units per year, only 20% is credited to plants in European USSR.

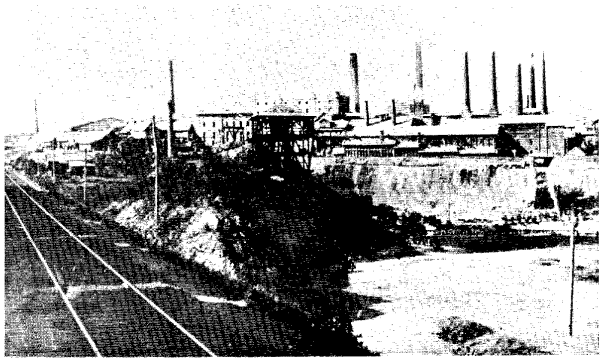


Figure IX-40. *Railroad equipment plant, looking north, near Moscow, 1943.*

3. Railroad equipment (Table IX-52).—Originally the most important centers for locomotive and railroad car construction were located in regions which have dense railroad networks, particularly in the central industrial regions: near Moscow (Figure IX-40) (the Kolomna locomotive plant and the Mytishchi railroad car factory), in Bezhitsa (Orel O.) (locomotive and railroad car construction), in Gor'kiy (locomotive and railroad car construction at the Sormovo plant), in Leningrad and Kalinin (railroad car construction). In addition, locomotive construction increased in the Ukraine (Khar'kov, and Voroshilovgrad).

Just prior to World War II, old plants were modernized and expanded. New types of locomotives were introduced and also new types of railroad cars such as high-capacity freight cars, upholstered passenger cars, subway cars, and others. At the same time, several new large plants were built: a locomotive plant in Voroshilovgrad, and railroad car factories in the Urals (Nizhniy Tagil) and in the Ukraine (Dneprodzerzhinsk and Kryukov).

It is impossible to estimate current production of motive power and rolling stock in the USSR. In 1940 about 52,000 freight cars and 920 steam locomotives were manufactured. Various estimates of the planned 1946 production are 200-300 locomotives and 31,000 to 44,000 cars. In May 1946 the output was estimated to be 75 cars daily and 10 locomotives monthly. Soviet authorities announced that it was planned to increase the tempo of production greatly during the third and fourth quarters of 1946. However, it is believed that production continued to be handicapped by delays in construction and restoration of plants as the plan for construction of repair plants had been fulfilled by less than 30% by May 1946. Therefore, it is not considered probable that the actual production was comparable with planned production. The Ministry of Transport Machinery has announced, that 1946 production of all transport machinery was only 81% of planned production. The loss of rolling stock which was over-used and the diminished production during the war have created the demand which is reflected in the current Five-Year Plan. The plan calls for the production by 1950 of 555 electric locomotives, 865 diesel locomotives, and 6,165 steam locomotives, 472,500 freight cars, and 6,000 passenger cars. Under the plan it is expected that production of locomotives in 1950 will be increased 2.6 times. The available information on production is so fragmentary that it becomes very difficult to estimate the percentage of the total produced by any one section of the country. By an admittedly rough estimate, it might be said that European USSR produced between 60% and 70% of the total USSR production. The development of new plants in the Urals, Central Asia, and the Far East may considerably modify that percentage figure in the near future.

By 1945 the production of rolling stock in the USSR had virtually ceased and delays in rebuilding and restoring plants continued to handicap production until the middle of 1946. Plants for the construction and repair of rolling stock are rather widely distributed throughout European USSR, but of those only 16 are major construction centers. These centers are: 1) Kolomna, which manufactures locomotives; 2) Voroshilovgrad, locomotives; 3) Bryansk, locomotives, tenders and cars; 4) Dneprodzerzhinsk, gondola and hopper cars; 5) Khar'kov, locomotives and cars; 6) Bezhitsa, freight cars and locomotives; 7) Kryukov, cars; 8) Mariupol', tank cars; 9) Novocherkassk, electric locomotives; 10) Moscow, electric locomotives, coaches for new electric trains; 11) Kalinin, flat cars, freight cars and passenger cars; 12) Leningrad, freight cars, locomotives, new type all-metal welded passenger cars; 13) Gor'kiy, locomotives, steel cars; 14) Murom, locomotives of the 9 P series; 15) Mytischi, cars for electric railways and subways; and 16) Kostroma, locomotives and cars.

TABLE IX - 52

RAILWAY EQUIPMENT PRODUCTION AND LOCATION, BY OBLAST, EUROPEAN USSR

Location	Number of plants	Production
North and Northwest:		
Arkhangel'skaya O	4	Repair of locomotives and cars.
Leningradskaya O	15	Mfg. freight cars (20-ton 2-axle type), all-welded metal passenger cars, armored locomotives, street cars, wheels (1,000 pairs daily), electric cranes, ore carts, lifts, switches, signal installations, and batteries; repair of locomotives and cars.
Murmanskaya O	4	Mfg. electric locomotives, steam locomotives, repair of locomotives (steam and electric) and cars.
Pskovskaya O	1	Locomotive repairs. About 50 locomotives in plant at once.
Vologodskaya O	2	Mfg. locomotives and cars; repair of locomotives and cars.
Karelo-Finnish SSR	3	Repair of locomotives and cars.
West:		
Kaliningradskaya O	1	Mfg. locomotives and cars.
Estonian SSR	3	Mfg. locomotives, hoists, condensers; repair of locomotives and cars.
Latvian SSR	6	Mfg. locomotives and cars, trolley cars, passenger cars of new electric type; repair of locomotives, passenger cars and freight cars.
Lithuanian SSR	5	Repair of locomotives and cars.
White Russian SSR:		
Baranovichskaya O	5	Mfg. of cars and repair of locomotives and cars.
Bobruyskaya O	1	Unspecified repairs.
Brestskaya O	3	Locomotive and car repairs.
Gomel'skaya O	6	Locomotive and car repairs.
Minskaya O	5	Passenger and freight car repairs and repair of wide and narrow gage locomotives.
Mogilëvskaya O	2	Mfg. of locomotives and repair of locomotives and cars. (One plant under construction in 1946.)
Molodechnenskaya O	1	Repair of locomotives and cars and railway tie impregnating.
Pinskaya O	3	Locomotive repairs (wide and narrow gage) and car repairs.
Polesskaya O	4	Locomotive and car repairs.
Polotskaya O	5	Locomotive and car repairs.
Vitebskaya O	5	Locomotive and car repairs, narrow gage locomotives as well as wide.
South:		
Chernigovskaya O	6	Locomotive and car repairs.
Dnepropetrovskaya O	8	Mfg. locomotives, 60-ton gondola freight cars, repair of locomotives and freight and passenger cars.
Drogobychskaya O	1	Locomotive and car repairs.
Kamenets-Podol'skaya O	5	Locomotive and car repairs.
Khar'kovskaya O	7	Mfg. electric locomotives, cars; repair locomotives and cars; mfg. of spare parts.
Khersonskaya O	1	Mfg. of locomobile cars.
South: (*continued*)		
Kiyevskaya O	13	Repair of locomotives and cars; mfg. of mechanisms for automatic blocking systems, electric measuring instruments for railways.
Kirovogradskaya O	3	Locomotive and car repairs.
L'vovskaya O	2	Locomotive and car repairs.
Odesskaya O	7	Mfg. cars, locomotive and car repairs.
Poltavskaya O	5	Mfg. 60-ton gondola cars, repair of locomotives and cars.
Rovenskaya O	6	Locomotive and car repairs.
Stalinskaya O	5	Mfg. of freight cars, tank cars; locomotive and car repairs.
Stanislavskaya O	1	Locomotive repairs.
Sumskaya O	3	Locomotive and car repairs.
Ternopol'skaya O	....	Locomotive repairs.
Vinnitsa	5	Locomotive and car repairs.
Volynskaya O	3	Locomotive and car repairs.
Voroshilovgradskaya O	4	Mfg. of locomotives—F. D., J. S., and S. O.; freight cars; repair of locomotives and cars.
Zaporozhskaya O	2	Locomotive and car repairs.
Zhitomirskaya O	4	Locomotive and car repairs.
Moldavian SSR	....	Locomotive repairs and unspecified repairs.
Southeast:		
Stavropol'skiy Kray	1	Locomotive repairs.
Groznenskaya O	1	Locomotive and car repairs.
Rostovskaya O	10	Mfg. industrial locomotives, narrow-gage locomotives, one of the principal mfg. of electric locomotives, U1-22, railroad cars; repair of locomotives, both wide and narrow gage, and of cars.
Volga:		
Astrakhanskaya O	1	Locomotive and car repairs.
Kuybyshevskaya O	6	Mfg. locomotives, and locomobile engines, repair of locomotives and cars.
Saratovskaya O	8	Mfg. freight cars; repair of locomotives and cars.
Stalingradskaya O	5	Mfg. of cars, especially of OB42, armored trains, car axles, couplings and brakes; locomotive and car repairs.
Ul'yanovskaya O	....	Repair of locomotives and cars.
Tatar SSR	4	Mfg. locomotives, freight and passenger cars, and repair of locomotives and cars.
Central Industrial:		
Bryanskaya O	3	Mfg. locomotives, flat cars, special types and heavy load railroad cars; unspecified repairs.
Gor'kovskaya O	12	Mfg. cars, locomotives (steam and diesel), 9P type locomotives, cars and armored trains; mfg. switches; locomotive and car repairs.
Ivanovskaya O	....	Mfg. parts; repair of locomotives and cars.
Kaliningradskaya O	10	Mfg. J. S., F. D., and S. O. locomotives, hand cars, axle bearings, flat cars repair of locomotives and cars.

TABLE IX - 52 (Continued)

Location	Number of plants	Remarks
Central Industrial: (*continued*)		
Kaluzhskaya O	3	Mfg. locomotives, cars, locomobiles, railway car hoists, and diesel engines; repair of locomotives.
Kirovskaya O	7	Mfg. railroad cars, cars for industrial railways, cranes, steam engine boilers and track dismantling machinery; repair of locomotives, cars and armored trains.
Kurskaya O	3	Locomotive and car repairs.
Mordovian ASSR	2	Repair of cars and overhauling of locomotives.
Moskovskaya O	30	Mfg. S. O., F. D., and J. S. locomotives, electric locomotives, diesel locomotives, and a new type of locomotive believed to be of the 1–5–0 type, special coaches for new electric train, all steel passenger coaches, subway cars, electric mine locomotives, locomobiles, freight cars, railway axles (50% of total USSR production), car hoses, compressed-air brakes air-distributing hoses, jacks, conveyor belts, cable cars, spare parts for locomotives and cars; repair of all types of locomotives and cars.
Orlovskaya O	2	Mfg. of Pobeda type locomotives, freight cars and flat cars.
Penzenskaya O	2	Mfg. of locomotives and cars; repair of locomotives and cars.
Ryazanskaya O	0	Mfg. equipment for 3 axle cars; repair of locomotives, mine locomotives and cars.
Smolenskaya O	3	Repair of freight cars and unspecified repairs.
Tambovskaya O	7	Mfg. freight, passenger and refrigerator cars, conversion of steam locomotives to oil burning, mfg. of armored trains; repair of locomotives and cars.
Tul'skaya O	7	Mfg. water pumps, snow cleaners, spare parts; repair of locomotives and cars, and of locomobile engines.
Velikolukskaya O	2	Locomotive and unspecified repairs.
Vladimirskaya O	2	Car repairs.
Voronezhskaya O	7	Repair of locomotives and cars of all types.
Yaroslavskaya O	11	Mfg. electric and steam locomotives, freight cars and armored trains, air brakes, motors for electric locomotives; repair of all types of locomotives and cars.
Ural'skiy:		
Baskhir ASSR	2	Locomotive and unspecified repairs.
Udmurt ASSR	4	Mfg. J. S. locomotives, freight cars for narrow gage railways.

4. AGRICULTURE MACHINE BUILDING.—Before the war the combine production centers in the USSR were distributed throughout the important grain regions: Ukraine (Zaporozh'ye), North Caucasus (Rostov-na-Donu), and the Volga area (Saratov). Construction of combines in the north is also carried on in the Moscow Region (Lyubertsy). In 1938, the USSR manufactured 22,900 grain combines. The manufacture of tractors and horse-drawn agricultural equipment such as ploughs, harrows, cultivators and seeders is also carried on in the important grain regions of the Union (FIGURE IX-41). A new large plant manufacturing various agricultural machines was built during the first Five-Year Plan in Rostov-na-Donu. Important centers for agricultural machine construction were the Ukraine: Khar'kov, Kirovograd, Odessa, Kherson, Osipenko, Stalino; and the RSFSR Lyubertsy, Orel. Machines are now used not only for grain cultivation and various farming operations, but also in other branches of agriculture. In this case, too, agricultural machine production develops in regions according to the needs of the various branches of agriculture. For instance, building of machines for flax and potato cultivation is carried on in western regions and in the central industrial regions—Rzhev and Torzhok (Kalininskaya Oblast'), Lyubertsy and Ryazan.

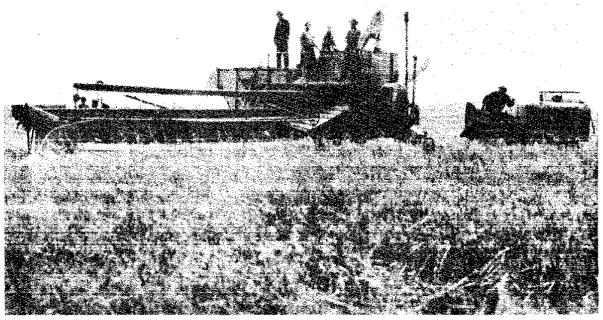


FIGURE IX-41. *Agricultural machinery, Kiev. Prior to 1940.*

The very high priority placed upon the production of agricultural machines and parts during the postwar reconstruction period has led to conversion of a great number of factories in unrelated industries such as aircraft and even railroad equipment plants to temporary production of parts for farm machinery.

The food situation of the USSR has continued extremely serious since the war due in part to shortages of farm equipment. Agricultural machinery factories were converted during the conflict to mortar production; farms had to get along with equipment on hand. Existing machines wore out, and there were not adequate spare parts with which to repair them. The Germans did extensive damage to farm equipment. While reconversion of agricultural machine plants started many months before the surrender of Germany, progress was slow. Since that time orders for farm machinery "have been given the same importance as orders for military equipment in time of war" and a great many plants not normally manufacturers of agricultural machinery have been given orders for parts. During the current Five-Year Plan the agricultural industry of the south is scheduled to regain much of its former importance.

5. ROAD AND CONSTRUCTION MACHINERY.—Most road and construction machinery plants of European USSR were located in the south where there was a fairly extensive highway network and important heavy industry. Reconstruction in the south stresses restoration of this branch of the machine-building industry under a high priority. The limited road net of the USSR and the backwardness of Soviet construction methods are reflected in the rather limited number of plants involved.

FIGURE IX-42
DZERZHINSKI TRACTOR FACTORY, STALINGRAD
JANIS 40
CONFIDENTIAL

Legend

Before Destruction

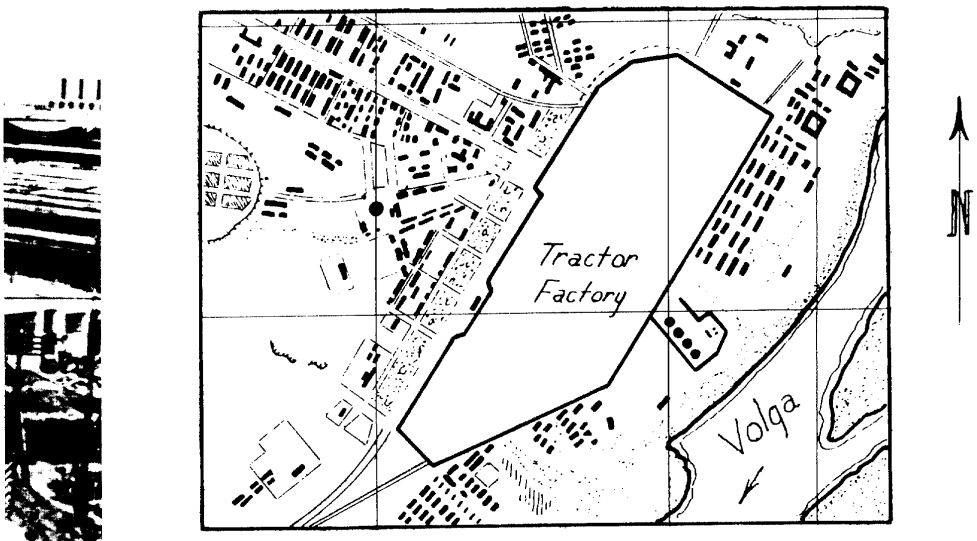
1	Mechanical & Assembly Dept No 1	about	36450 sq meters
2	" " " " No 2	"	11800 "
3	Assembly Dept No 3	"	16750 "
4	Steel Foundry	"	40650 "
5	Foundry	"	18470 "
6	Forge	"	8430 "
7	Press Shop	"	15600 "
8	Repair and Construction Dept	"	3900 "
9	Tool Dept	"	6080 "
10	Electric Motors Dept	"	3300 "
11	Administration	"	980 "
12	Printing Shop	"	300 "
13	Kindergarten	"	150 "
14	Charging of Accumulators	"	600 "
15	Storage	"	1700 "
16	Pattern Shop	"	2090 "
17	" "	"	580 "
18	Main Storage	"	3080 "
19	Mechanical Dept	"	7470 "
20	Power Plant	"	750 "
21	Forge	"	2070 "
22	Transformer Stations	"	900 "
23	Tractor Sheds	"	1900 "
24	Fuels and Lubricant Storage	"	5600 "
25	Storage of Acids	"	1500 "
26	Storage Space (Covered)	"	2300 "
27	Locomotive Depot	"	1000 "
28	Woodworking Shop	"	750 "
29	Storage	"	1600 "
30	Munitions Dept	"	1200 "
31	Building Under Construction	"	16800 "
32	Unknown	"	4200 "
33	Workers' Settlement		
34	Dwelling Houses		

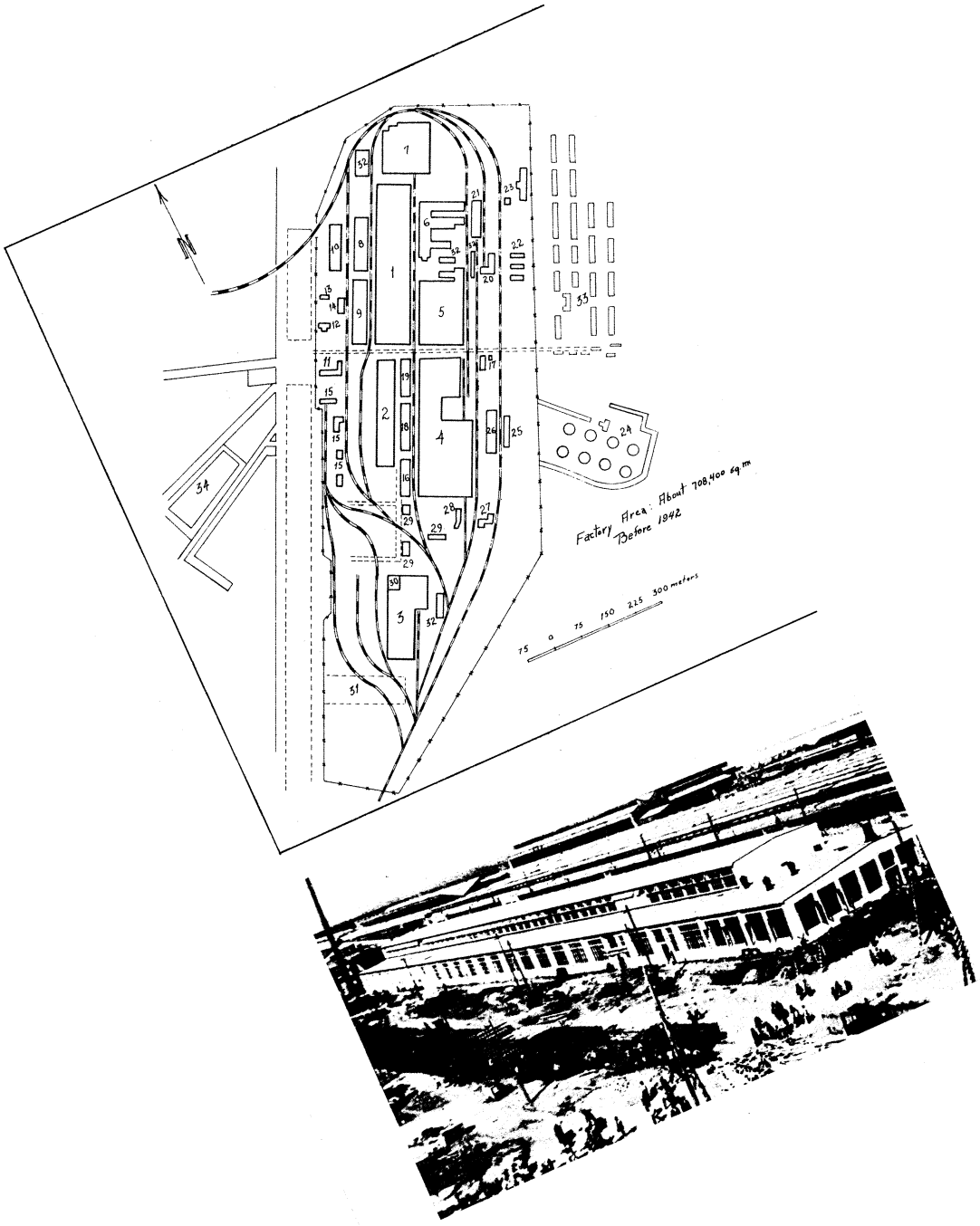
Built up area about 213950 sq meters

After Reconstruction

2	Mechanical Dept	about	11800 sq meters
3	Testing Dept & Administration	"	16750 "
4	Mechanical & Assembly Dept	"	40650 "
5	Foundry	"	18470 "
6	Forge	"	8430 "
9	Tool Dept	"	6080 "
10	Stamping & Pressing Shop	"	7200 "
15	Storage Rooms	"	2680 "
16	Temporary Power Plant	"	2090 "
18	Tank Repair Shop	"	3090 "
19	Forge & Welding Shop	"	2470 "
24	Fuel & Oil Storage	"	5600 "
23	Guardhouse	"	600 "
33	Workers' Settlement		
34	Dwelling Houses		

Built up area about 125900 sq meters





Due to the lavish use of manpower in the Soviet Union and backward methods of construction employed, this branch of the machine building industry does not have the importance in the Soviet Union which it enjoys elsewhere. It is being expanded and modernized under the fourth Five-Year Plan, and additional plants to be constructed in the East will balance reconstruction and expansion of plants in European USSR, so that the full prewar preeminence of the European area will not be regained.

6. MACHINE TOOLS.—Leningrad and Moscow, with their skilled industrial populations, were the important prewar centers of the machine tool building industry. Modern plants were also found at Gor'kiy, where milling machines were produced, and Khar'kov and Kiev in the Ukraine, where automatic lathes and metal planers were made. About 35% of machine tool production capacity was in occupied areas. During the war, machine tool plants enjoyed a very high evacuation priority, and most machine tool capacity and tools of occupied areas were probably evacuated. In 1942 unoccupied areas had about 35 machine tool factories, some 20 of which were in European USSR. It is estimated that machine tool plants evacuated during the war will stay where they were moved and will be replaced in their former locations by reparations equipment or by new machinery.

The production of machine tools will rise during the period of the fourth Five-Year Plan but less than some other items of machinery. The tabulation on metal-cutting lathes illustrates the rise in tool output. Aggregate machine tool production will rise to 12.4 thousand units

Year	Output of Metal-Cutting Lathes *Physical units*
1936	32,400
1938	53,900
1950	74,000

in 1950. By the end of the fourth Five-Year Plan the Soviet Union is scheduled to have an inventory of 1.3 million metal-cutting machine tools. This total is 130% of the inventory of metal-cutting tools possessed by the United States in 1940 and is a very important figure. It shows the effect of lend-lease and reparations as well as of domestic production in adding to the Soviet inventory of machine tools. It is a measure of the ability of the nation to produce machinery and would indicate that in 1950 if the plan is carried out, the USSR will have a potential for production of machinery, industrial equipment, and armaments similar to that of the United States in 1940. European USSR will not regain the relative importance in this field which it enjoyed before the war, but should regain first place by 1950.

The proportion of the various branches of the machine building industry within European USSR to production in the USSR as a whole is set forth in TABLE IX-53.

(d) Machine building problems.—Tremendous losses were inflicted by the German invaders. They wrecked 749 heavy and medium machine-building plants, employing 919,000 workers. The heaviest damage was caused to the following plants: the Kramatorsk with 25,000 workers, the Voroshilovgrad with 23,000 workers, the Bezhitsa with 20,000 workers, the Khar'kov with 5,000 workers, the Taganrog with 4,000 workers, the Lydinovo with 6,000 workers and the Leningrad Russky Diesel with 3,000 workers.

The Germans caused great damage to enterprises producing tractors, automobiles, railway cars, motorcycles, and bicycles. They completely destroyed 21 and partially wrecked 27 such factories; the huge Stalingrad and Khar'kov tractor plants were reduced to ruins; the Khar'kov, Gomel, and Rostov repair and ball-bearing works were wrecked; the Kalinin, Kryukov, and Bezhitsa car-building works with an annual output of 23,000 freight cars; the Khar'kov bicycle and the Leningrad motorcycle factories were destroyed.

The German invaders wrecked 64 machine-tool and abrasives works including the Khar'kov, Kramatorsk, Krasnodar, Kiev, Odessa, Minsk, Leningrad, and other plants.

They completely destroyed 169 plants producing agricultural, chemical, wood-working, and paper-making machinery.

(e) Plant characteristics (FIGURE IX-42).—Although there are wide differences in the lay-out and facilities of plants in different branches of the machine-building industry, the Stalingrad Tractor Factory dedicated to Dzerzinski may be considered as somewhat typical for this sector of USSR industry.

TABLE IX - 53

MACHINE BUILDING

(Estimated values in millions of 1926/27 rubles)

Branch of industry	1938				1946			
	Percent of branch to total machine building industry, all USSR	Value of production		Percent of production in European USSR	Percent of branch to total machine building industry, all USSR	Value of production		Percent of production in European USSR
		European USSR	Total USSR			European USSR	Total USSR	
Mining and metallurgical	6	990	1, 650	60	8	672	2, 240	30
Power machinery	13	2, 864	3, 580	80	7	1, 176	1, 960	60
Total heavy machinery	*19*	*3, 854*	*5, 230*	*74*	*15*	*1, 848*	*4, 200*	*44*
Machine and apparatus	35	7, 704	9, 630	80	28	2, 980	7, 840	60
Vehicles	5	1, 233	1, 370	90	10	6, 104	2, 800	80
Railroad equipment	20	3, 850	5, 500	70	18	3, 024	5, 040	60
Road and construction machinery	2	440	550	80	4	672	1, 120	60
Agricultural machinery	9	1, 976	2, 470	80	15	2, 520	4, 200	60
Total medium machinery	*71*	*15, 203*	*19, 520*	*78*	*75*	*15, 300*	*21, 000*	*73*
Machine tools	10	2, 063	2, 750	75	10	680	2, 800	35
Total	100	21, 120	27, 500	76	100	17, 828	28, 000	66

Prior to World War II, this was the largest tractor plant in the USSR. It built T-34 medium tanks in the first months of the war, and possibly just before the war. The plant area of 708,400 square meters (847,218 square yards), with 125,900 square meters (150,571 square yards) of built-up area, is located northeast of the city of Stalingrad, on the west bank of the Volga. The plant was started in 1928 under the first Five-Year Plan, and was not completed by the outbreak of the war. The first departments were in operation in 1931. The factory was intended for the production of wheeled tractors and caterpillars. According to some reports, tank production was to have been started even before the war. These reports are probable considering the corresponding development of Plant No. 183 at Khar'kov (Khar'kovskaya Oblast') in the Ukraine. At the latest, conversion to tank production took place at Stalingrad at the beginning of the war. On the basis of a decision of the People's Commissariat for Defense, Stalingrad plants were not to be evacuated at once on the approach of German troops, but had to continue working. Preparations were made to dynamite the entire plant. Evacuation of the tractor plant was permitted only in the late summer of 1942, and since preparations were inadequate, severe losses in matériel resulted. The largest part of the machinery was sunk in the Volga, but the most valuable parts of the equipment were evacuated. Some went to Motor Factory No. 77 in Barnaul (Altayskiy Kray); Voroshilov Plant No. 174 at Omsk; Uralsmashzavod at Sverdlovsk and the Altai Tractor Plant in Rubtsovsk (Altayskiy Kray).

Since the tractor factory had suffered less by the fighting than the town and other industrial plants, its reconstruction had already been started in February 1943, and after eight months, production was half of pre-war. Production included tank repairs. The plant became known as the largest tank repair shop on the Southern Front, but there is no evidence to support numerous reports that the T-34-85 medium tank was actually produced at Stalingrad before the end of hostilities. Postwar production of heavy STZ-NATI caterpillar tractors reached 3,500 in 1945 and 5,200 units in 1946. A new diesel-powered tractor has been built at the plant, and by 1950 production of this type of machine is scheduled to reach 25,000 per year.

Before the war the plant had a steel foundry with ten electro-furnaces and a yearly steel capacity of 30,000 metric tons. The steam power station of 7,000 kw. was destroyed. Reconstruction was accomplished with two emergency diesel-electric motors of 600 hp. each.

(3) Chemical industry (FIGURE IX-65)

(a) Location.—By Soviet definition the term "Chemical industry" includes production of: 1) aniline dyes; 2) mining chemicals; 3) nitrogen and nitrate fertilizers (FIGURE IX-43); 4) phosphorus; 5) potassium; 6) sulfur; 7) lacquers and paints; 8) pharmaceuticals; 9) plastics; and 10) poison gases and war chemicals. Acetic acid production by wood distillation is a part of the Soviet timber industry. The term chemical industry as used here will include the various branches as defined by the Soviets, as well as acetic acid and rubber. Plants known only for their manufacture of powder and explosives, however, are considered under Armament and Munitions.

The center of the wood-chemical industry is the Northwestern Region which lies in the forest belt of the Soviet Union. Major products of the wood-chemical industry include turpentine and rosin, acetic acid from the destructive distillation of wood, and wood-cellulose products. Leningradskaya and Arkhangel'skaya Oblasti are the chief chemical centers in this region.

FIGURE IX-43. *Phosphate surface mines on Gora Kukisvomchorr, looking southeast, Kirovsk. 1946.*

The prewar phosphate fertilizer industry of the Soviet Union was based almost entirely on the Khibin apatites on the Kola Peninsula, in Murmanskaya Oblast'. The Western Region was never a significant chemical manufacturing area, as it lacks raw materials.

The South contains more chemical plants than any region except the Central Industrial, but the great majority were ruined during the war, and most of the rest were evacuated. Sixty percent of prewar coal production came from the Donbass, largely lying in the Ukraine, and destructive distillation of coal accounts for nearly half the plants in the area. The presence of metal refineries provides chemical byproducts.

The Ukraine, a rich agricultural area, provides grain for alcohol and animal fats and casein. The nearby Ciscaucasus, with important petroleum refineries, yields chemical byproducts for the manufacture of paint and artificial rubber. Rostovskaya Oblast', in the Southeast Region, is rubgraphically an extension of the Donbass, and has coal mining and metallurgy as the basis of a substantial chemical industry. The Volga industrial region has a well-balanced chemical production, utilizing varied chemical raw materials, including sulfur and petroleum.

Nearly a third of the chemical plants known in the Soviet Union are located in the Central Industrial Region. Raw materials are brought by rail, and the skilled labor available is devoted to intricate chemical processes, such as synthetic fuel, synthetic rubber, and other artificial materials, drugs, dyes, and chemical warfare agents. Less intricate processes, such as the production of superphosphates, are also represented. Moskovskaya Oblast', with over 100 plants, leads chemical production in the region (FIGURE IX-44) but the Gor'kovskaya Oblast', east of Moscow, with its huge Dzerzhinski combine, is also of importance.

(b) Production.—Prewar chemical production was distributed roughly as indicated in the tabulation showing percentage by economic region:

ECONOMIC REGION	PERCENT
Northern	26.7
Southern	8.8
Central Industrial	56.5
Other	8.0
Total, USSR	100.0

While over 60% of the Soviet chemical plants were evacuated to the east in 1941, many were returned in 1942.

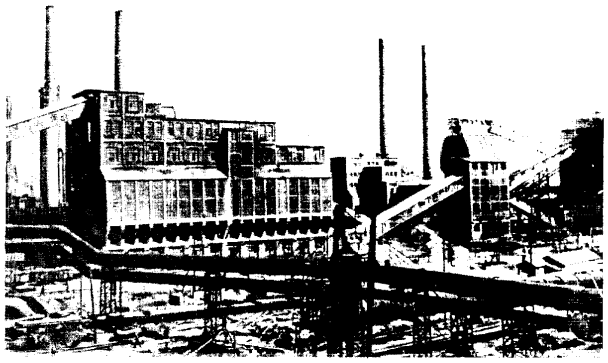


FIGURE IX-44. *Coke and chemical plant, near Moscow. 1932.*

The contribution of chemical industry in European USSR in 1943, added to production in the Urals, brought over-all production of the USSR up to the prewar level of production, and even higher in certain branches. The Soviet authorities expected that by the end of 1944 the Leningradskaya Oblast', would reach almost half its prewar production rate, the Moskovskaya Oblast' approximately 90%, and Tul'skaya Oblast' 25.5% of their former output. The Soviet claim that the 1944 output of the chemical industry as a whole exceeded prewar volume appears to be credible.

During the second half of 1945 the Soviet chemical industry commenced reconversion to civilian production. It increased the production of mineral fertilizers, dyes and consumers' goods. The prewar volume of consumers' goods, largely produced in European USSR, was regained by the end of 1945.

(c) Chief products.—The geographic distribution of the Soviet chemical industry is shown in TABLE IX-54 by economic region, and oblast.

(d) Special problems.—The Soviet Union's chemical industry was badly hit by the war. Over 60% of her chemical productive facilities were evacuated during 1941 or lost to the enemy. The Germans destroyed 66 mixed fertilizer and chemical plants, as well as plants producing rubber and rubber products and asbestos and asbestos goods factories, including the Stalinogorsk and Rubezhan chemical works; the Konstantinov, Perekop, Saki, and Khar'kov chemical works; the Dneprodzerzhinsk, Gorlovka, Lisichansk, and Stalino mixed fertilizer plants, and the Odessa and Vinnitsa superphosphate works.

The eastward movement of the industry, and the rapid rise of the chemical industry in the Urals started during the third Five-Year Plan (1938-1941). This eastward movement increased efficiency. For example, the sulfuric acid industry of the Central Region had always depended on certain raw materials from the Urals, and between 2,000,000 and 2,500,000 freight ton-kilometers a year were wasted hauling copper pyrites.

Consideration of production, above, has indicated that when the German tide was turned in 1942, the Soviets moved much of their evacuated machinery back into the Central Industrial region, and later into the area around Leningrad. This return was to take advantage of the skilled labor living in those districts and the permanent installations of the industry.

Since many industrial processes are common to both war and peacetime chemical production, reconversion is simpler than most other industries. Frequently a mere cleaning of vats, grinders, mixers, and conveyors suffices to keep common impurities from any new product. Common war gases can be produced by commercial chemical plants within a conversion period of 24 hours. Necessary plans, new materials, and supplementary equipment such as meshes and protective clothing of the workers are kept in readiness by the permanent peacetime military sections of the plants at all times. As a part of the postwar reconstruction of this chemical industry the Soviets had the choice of, a) removing chemical plants from Germany, with a resulting loss in output as a result of moving them; or b) leaving the plants in Germany and taking their output as reparations and as payment for Soviet food and goods delivered to Germany. Since the latter alternative involved the risk of losing the facilities altogether once the final peace settlement was made with Germany, the Soviets decided on plant removal. Wholesale transfers of facilities and hundreds of scientists and technicians to the USSR were effected. Equipment was dumped on flatcars and ships by unskilled workers. Frequently whole shipments of instruments arrived in Russia corroded and useless. The equipment moved lost from 60% to 80% of its usefulness in the process.

Plant restoration in Russia, once the German equipment had arrived, presented more problems. German chemists were moved in to operate the plants, but engineers and workmen were needed to set them up. Both are scarce in the Soviet Union. New houses, roads, drainage systems, and other facilities had to be built. Again, both materials and labor were needed.

As a result of these difficulties, virtually no chemicals have been turned out by transferred plants. Some facilities for producing sulfuric acid and other heavy chemicals that involve simple processes are just beginning to get into operation.

The Soviet aim now is to supply her own industries and farms with enough chemicals to allow them to produce at maximum capacity. Soviet hopes for setting up a great chemical industry have not been abandoned. But the day when Soviet chemical exports will become a factor in world markets is considered far away.

One important objective of the Soviet chemical industry is to achieve the greatest possible self-sufficiency in rubber. When the German attack on the USSR began, the Soviets probably had more experience in the production of synthetic rubber and a larger output of this product than any other country, Germany included. Before 1940 all synthetic rubber produced in the Soviet Union was *Divinyl*, derived from alcohol made from grain or potatoes.

An almost complete change-over by the rubber fabrication industry from imported natural rubber to synthetic rubber was accomplished by 1939. In 1940 another type of synthetic rubber, *Sovpren* (similar to neoprene), was developed. This product did not utilize foodstuffs as raw material, but rather lime, salt, coal, and coke. Experiments with several other types of synthetic rubber have also been made, and the development of domestic sources of natural rubber of the guayule variety has received much attention in recent years. However, actual production of this kind remains small. Although certain products can be made entirely of synthetic rubber, natural rubber must be added in the construction of heavy-duty tires and other items of military importance. Lend-lease imports of over 150,000 tons of natural rubber were obtained from Great Britain during the war, in addition to nearly 2,500,000 truck tires from the United States.

Main regions of the synthetic rubber industry were Leningrad, Moscow, Yaroslavl' (Yaroslavskaya Oblast'), Voronezh (Voronezhskaya Oblast'), Kazan' (Tatar ASSR) and Yefremov (Tul'skaya Obalst'). The last two were evacu-

TABLE IX - 54

GEOGRAPHIC LOCATION OF CHEMICAL INDUSTRY, BY OBLAST *

	Mineral and organic acids	Hydrocarbon distillation products	Industrial solvents	Caustic soda and chlorine	Nitrogenous compounds	Phosphatic products	Paper industry chemicals	Industrial gases	Electrothermal furnace products	Fats and waxes	Pigments and paints	Insecticides, fungicides, and disinfectants
North:												
Karelo-Finnish SSR	..	1	..	..	..	..	..	..	..	..	..	..
RSFSR:												
Arkhangel'skaya O	3	9	4	4	3	..	..	..	..	2	..	..
Komi ASSR	1	..	..	..	..	..	..	..	..	..	1	..
Leningradskaya O	11	11	9	3	12	4	..	6	4	7	9	..
Murmanskaya O	..	..	..	..	..	3	..	..	..	..	..	..
Vologdoskaya O	2	5	..	..	3	..	..	..	..	..	2	..
West:												
Estonian SSR	..	..	..	..	..	1	..	..	..	..	..	..
Latvian SSR	..	..	..	..	..	1	..	..	..	..	..	..
Lithuanian SSR	..	..	..	..	1	..	..	..	..	..	..	..
RSFSR:												
Gomel'skaya O	1	2	..	..	..	..	..	..	..	1	2	..
Minskaya O	..	2	..	..	1	..	..	1	..	..	..	..
Mogilëvskaya O	1	1	2	..	..	1	..	..	..	..	..	..
South:												
RSFSR:												
Krymskaya O	1	1	..	1	..	..	..	..	1	..	1	..
Ukrainian SSR:												
Chernigovskaya O	..	3	..	..	..	..	..	..	..	..	..	..
Dnepropetrovskaya O	4	7	1	3	3	2	..	..	2	2	1	1
Kaments-Podol'skaya O	..	1	..	..	..	..	..	..	..	..	..	..
Khar'kovskaya O	..	1	1	1	..	1	..	1	..	3	2	..
Kiyevskaya O	2	2	5	..	1	..	..	..	..	2	2	2
Kirovogradskaya O	1	..	1	..	..	..	..	..	..	2	1	..
Nikolayevskaya O	1	..	..	..	..	..	..	..	..	2	..	1
Odesskaya O	2	..	2	2	..	1	..	..	..	3	2	1
Poltavskaya O	1	..	2	..	..	..	..	..	..	2	1	..
Stalinskaya O	4	15	2	1	4	2	..	3	4	1	1	4
Stanislavskaya O	..	..	..	1	..	..	..	..	..	..	..	..
Sumskaya O	1	..	..	..	..	..	..	..	1	..	..	..
Vinnitskaya O	..	..	..	..	..	1	1	..	..	..	..	..
Voroshilovgradskaya O	3	11	2	2	2	..	..	..	1	..	..	1
Southeast:												
RSFSR:												
Rostovskaya O	..	1	..	..	2	..	..	..	..	5	3	2
Volga:												
RSFSR:												
Astrakhanskaya O	..	..	..	1	..	..	..	..	..	..	..	1
Bashkir ASSR	..	1	..	..	..	..	..	..	..	..	..	..
Kuybyshevskaya O	1	1	1	3	3	..	..	..	..	..	..	2
Saratovskaya O	..	3	1	1	..	..	..	2	..	1	1	2
Stalingradskaya O	..	2	2	2	..	1	..	1	..	1	1	..
Tatar ASSR	3	..	1	2	1	..	..	..	..	1	..	..
Central Industrial:												
RSFSR:												
Chuvash ASSR	..	..	..	1	2	1	..	..	..	..	..	4
Gor'kovskaya O	7	11	5	4	6	2	..	1	..	2	..	2
Ivanvoskaya O	5	1	9	..	3	1	..	..	1	..	1	..

* Principal products by category are:
Mineral and organic acids—acetic, hydrochloric, nitric, sulfuric acids.
Hydrocarbon distillation products—ammonium sulfate, benzol, creosote, dyes, naphthalene, pitch, tar, toluol.
Industrial solvents—alcohol (methyl, ethyl, isopropyl), acetone.
Caustic soda and chlorine—salt, saline compounds, soda ash, halogens, borax.
Nitrogenous compounds—fertilizers (natural and synthetic), munitions, ammonia, cyanamide.
Phosphatic products—superphosphates, mixed fertilizers (commercial).
Paper industry chemicals—sodium sulphide, sodium thiosulphate, sodium hyposulphite.
Industrial gases—common, hydrogen, oxygen, acetylene.
Electrothermal furnace products—calcium, carbide, abrasives (artificial), graphite (artificial).
Fats and waxes—glycerine, soap.
Pigments and paints—cadmium, carbon black, lacquers, lead, titanium, zinc.
Insecticides, fungicides, disinfectants—alkaloids, lead-arsenic, lime-sulfur, mercurials.

TABLE IX - 54 (Continued)

	Mineral and organic acids	Hydrocarbon distillation products	Industrial solvents	Caustic soda and chlorine	Nitrogenous compounds	Phosphatic products	Paper industry chemicals	Industrial gases	Electrothermal furnace products	Fats and waxes	Pigments and paints	Insecticides, fungicides, and disinfectants
Central Industrial: (Continued)												
RSFSR: (Continued)												
Kalininskaya O.	1	2	1	..	..	..	..	..	..	..	..	1
Kirovskaya O.	..	1	1	..	1	..	1	..	..	..	..	..
Kurskaya O.	..	..	..	1	..	2	..	..	..	..	1	..
Moskovskaya O.	15	15	10	16	17	14	1	1	1	10	15	9
Orlovskaya O.	1	3	1	..	..	2	..	..	..	..	..	..
Ryazanskaya O.	1	..	20	1	..	..	..	..	..	..	..	..
Smolenskaya O.	..	..	..	..	1	1	..	..	..	..	..	..
Tambovskaya O.	1	3	1	..	2	..	..	1	..	..	1	..
Tul'skaya O.	3	3	17	1	3	1	..	..	..	..	..	..
Voronezhskaya O.	1	2	1	..	..	..	..	1	2	1	..	2
Yaroslavskaya O.	4	2	..	4	5	2	..	2	..	1	4	..

ated, while the Leningrad factories and a small plant at Yelets (Orlovskaya Oblast') were lost. Rubber output in early 1942 declined to about one-third of prewar totals. Considerable improvement apparently occurred in late 1942 as evacuated plants were relocated. The Soviet government has placed prewar annual synthetic rubber at 108,000 to 144,000 tons; the early 1942 annual output rate at 36,000 to 48,000 tons, and the annual rate for 1943 at double the 1942 figures. If planned 1943 and 1944 construction was accomplished, the 1944 synthetic output was considerably over 1943.

Rubber reclamation plants in the USSR have a capacity of about 32,000 tons per year. It is not known whether enough old rubber is available to meet this capacity; reportedly the technique of reclamation had not progressed enough by 1939 to permit reclamation of old tires. In that year there were 6,000 tons of used tire scrap lying idle at the Krasni Treugolnik plant in Leningrad. In 1940 the Yaroslavl' reclamation plant was obtaining rubber from old tires, and it may be inferred that by now all reclamation capacity has been adapted to process tires. If this is so, annual reclaimed rubber production of European USSR should be in the neighborhood of 30,000 tons. Soviet reclamation plants in operation in June 1940 were located at Leningrad, Moscow, Kalinin, Ivanovo, and Yaroslavl'.

Although the plastics industry in the Soviet Union was first established in 1901, there was insufficient qualified personnel after the Revolution to give the required progress, and foreign technical assistance has been lacking. A general backwardness has resulted in this important branch of modern technology.

The chief types of plastics produced are galalite, carbolite, bakelite, and celluloid. Galalite is produced from casein, which is prepared from skimmed milk. It is used for the production of electrical appliances, buttons, pencils, pens, and combs. Carbolite and bakelite are produced from phenols, principally from carbolic acid, which is produced by dry distillation from wood and coal. Carbolite is used in machinery manufacture (ball bearings, shafts, and certain machine parts), in electrical engineering (insulators, gages), and in the production of consumer goods Bakelite is used for manufacture of electrical equipment. chemical apparatus, phonograph records, etc. The raw material for celluloid is wood. The most important use for celluloid is motion picture and photographic film production. It is also used for the manufacture of shatterproof glass. Formerly the production of all types of plastics was located primarily in the Leningradskaya, Moskovskaya, Kalininskaya, and Vladimirskaya Oblasti, and no known production was inaugurated to the east during the war. In the postwar period pressure molding of plastics for the motor vehicle industry is being emphasized.

(e) Typical installation.—The Electro-Chemical Combine No. 11, dedicated to Stalin, is selected as a generally representative chemical installation. It includes the plant formerly called the Stalin Dye Works No. 492. It is located at Stalinogorsk (Moskovskaya Oblast') on the Tula-Penza railroad line and was completed in 1937. After destruction by the Germans and wartime restoration, it produced dyes, sulfuric acid, chlorine compounds, calcium carbide, corbonic acid, aluminum compounds, methyl alcohol, aluminum, nitrogenous fertilizers, technical nitrogenous products. There are three large groups of structures. One, on the west bank of the Maklets River has the following 14 brick buildings equally-spaced in three rows: 1) phenol plant; 2) benzol storage; 3) sulfurization plant; 4) boiler forge; 5) generators; 6) waste-water filtration; 7) acid plant; 8) storage building; 9) mechanical workshops; 10, 11) unidentified; 12) ozone plant; 13) denitration plant; 14) dry-ice plant. East of the river, and south of a railroad spur is the chlorine factory, and north of the spur are the dye works with the following: 1) aniline dye plant; 2) tower sulfuric acid plant; 3) contact sulfuric acid plant; 4) carbide plant; 5) synthetic methyl alcohol plant; 6) aluminum plant; 7) nitrogenous fertilizer p'ant; 8) ammonia plant; 9) ammonium sulfate plant; and 10) ceramics plant.

It would be difficult to place this installation underground due to the necessary piles of raw material, the necessity of ventilating thoroughly an underground area used for processes giving off noxious fumes, and the fact that gaseous and liquid wastes tend to mark the plant location by killing vegetation unless piped a considerable distance away.

(4) Petroleum refining (FIGURE IX-65)

(a) Location.—Before World War I Russian petroleum refineries were located in the Caucasus; as a result of the first and particularly the second Five-Year Plan, the regional distribution of petroleum refineries underwent fundamental changes. A number of large plants were

TABLE IX - 55

GEOGRAPHIC LOCATION OF PETROLEUM REFINERIES, BY OBLAST, EUROPEAN USSR

Installations	Number of plants	Remarks
North:		
RSFSR:		
Komi ASSR	2	Two plants, both under MVD administration, one brought from Baku has full production cycles.
Leningradskaya O	4	A major petroleum refining installation and a minor one and two small plants working oil shale.
Pskovskaya O	1	Shale distillation plant.
West:		
Estonian SSR	9	Shale distillation plants.
Latvian SSR	1	Petroleum refinery with large prewar capacity.
South:		
Ukrainian SSR:		
Dnepropetrovskaya O	1	Mineral oil byproducts of nitrogen plant.
Drogobychskaya O	3	Large petroleum refineries.
Khar'kovskaya O	1	Petroleum refinery and synthetic plant using lignite.
Khersonskaya O	1	Petroleum refinery.
L'vovskaya O	1	Large petroleum refinery.
Odesskaya O	1	Major petroleum refinery.
Stalinskaya O	1	Petroleum refinery. Also small benzol plant.
Zarpatskaya O	1	Small petroleum refinery.
Zaporozhskaya O	1	Petroleum refinery.
Southeast:		
RSFSR:		
Rostovskaya O	2	Synthetic lubricants.
Volga:		
RSFSR:		
Astrakhanskaya O	1	Petroleum refinery.
Kuybyshevskaya O	5	Includes one of the largest of prewar Soviet petroleum refineries; a lend-lease petroleum refinery with 100 octane gasoline facilities; two small Soviet refineries and a shale-distillation plant.
Saratovskaya O	1	Approximately 30 cracking plants. Refinery produces wide range of light petroleum fractions.
Stalingradskaya O	1	Small petroleum products plant.
Tatar ASSR	1	Petroleum refinery, believed under construction.
Central Industrial:		
RSFSR:		
Gor'kovskaya O	3	Two large and one small petroleum refineries.
Moskovskaya O	4	One large unit with complete cycle; others small.
Tul'skaya O	1	Synthetic gasoline plant; partially restored.
Yaroslavskaya O	2	An Atlantic petroleum refinery and cracking plant; and an Atlantic nitro-benzol extracting plant.

erected in cities on the Volga (Saratov, Sormovo, Gor'kovskaya Oblast'; and Konstantinovskiy, Yaroslavskaya Oblast') for the purpose of processing Caucasian oil at its water-to-rail transshipment points. Refineries were built in Kherson in Khersonskaya Oblast'; Odessa and Osipenko (Zaporozskaya Oblast') at points where oil was transshipped between rail and sea. Petroleum refineries were established in Moscow and Leningrad. Under the third Five-Year Plan, further changes were to take place in the geographic distribution of oil refineries; a large number of new plants processing 6 million tons of oil per year were to have been built in the "Second Baku" area between the Volga and the Urals. Old plants were to have been expanded and new ones built in all oil fields until all oil could be refined at its source. New refineries for Caucasian oil were to have been established in the center of the country, along the Volga, and in the Ukraine. The third Five-Year Plan started in 1938, but was cut short in 1941 by German invasion of the USSR. Enormous damage was done to the Soviet petroleum industry during German occupation, but before the Soviets and Germans were enemies they collaborated, and in 1940 the USSR took title to the Baltic States of Esthonia, Latvia, and Lithuania, with their shale-oil industry, and added the large refineries of Drogobych, Lvov, and Stanislav to the Ukrainian SSR through the fourth partition of Poland. During the war the United States sent to the USSR complete equipment for four refineries and competent engineers to assist in their erection. Plant Number Three at Kuybyshev is in partial operation only and American engineers were working there in 1947. The other American plants are farther to the east. Provisions of the fourth Five-Year Plan for refinery construction may be regarded as modest. They include erection of three petroleum refineries to furnish oil products for industry and agriculture in the south.

(b) Production (TABLE IX-55).—In 1947 refining facilities exceeded Soviet crude-oil output, since a much smaller percentage of refining facilities than of petroleum production was lost as a result of war damage. However, by 1949 crude-oil output will probably again exceed refining capacity, due to reconstruction of war-damaged fields and exploitation of new fields. Of the one million metric tons of the prewar annual production of Polish facilities taken over by the Soviets, an estimated 455,000 tons have been restored. Baltic shale refineries will not reach their prewar 225,000 ton annual production until 1950, but are producing an estimated 100,000 tons annually. In 1938, districts of the USSR outside the Caucasus processed only 4.2% of the crude oil and 12.1% of the total gasoline produced. Due to German destruction and to wartime wastage in the Caucasus, and expansion in other regions, percentages of oil treated and gasoline produced in European USSR has probably doubled. Some idea of the extent of Soviet operations can be obtained from the tabulation of prewar petroleum refinery production for the USSR as a whole.

PREWAR PETROLEUM REFINERY PRODUCTION, USSR
(Thousand metric tons)

Year	Crude Processed	Gasoline	Lingroine	Kerosene	Residual Fuel Oil	Lubricating Oil
1938	28,420	3,677	1,421	6,321	15,580	1,998
1939	29,248	3,891	1,327	5,870	14,640	2,154
1940	30,790	4,199	1,429	6,595	15,480	2,276

Before the war, the Soviet Union is believed to have had six or eight plants manufacturing synthetic gasoline from soft coal and lignite; these were located in soft coal and lignite regions and may be presumed to have lost much of their productivity during the war. At least as great a number of German synthetic plants including the important Leuna installation, have been dismantled and sent to the USSR. There is insufficient information at present to give any picture of the location of this industry. Much

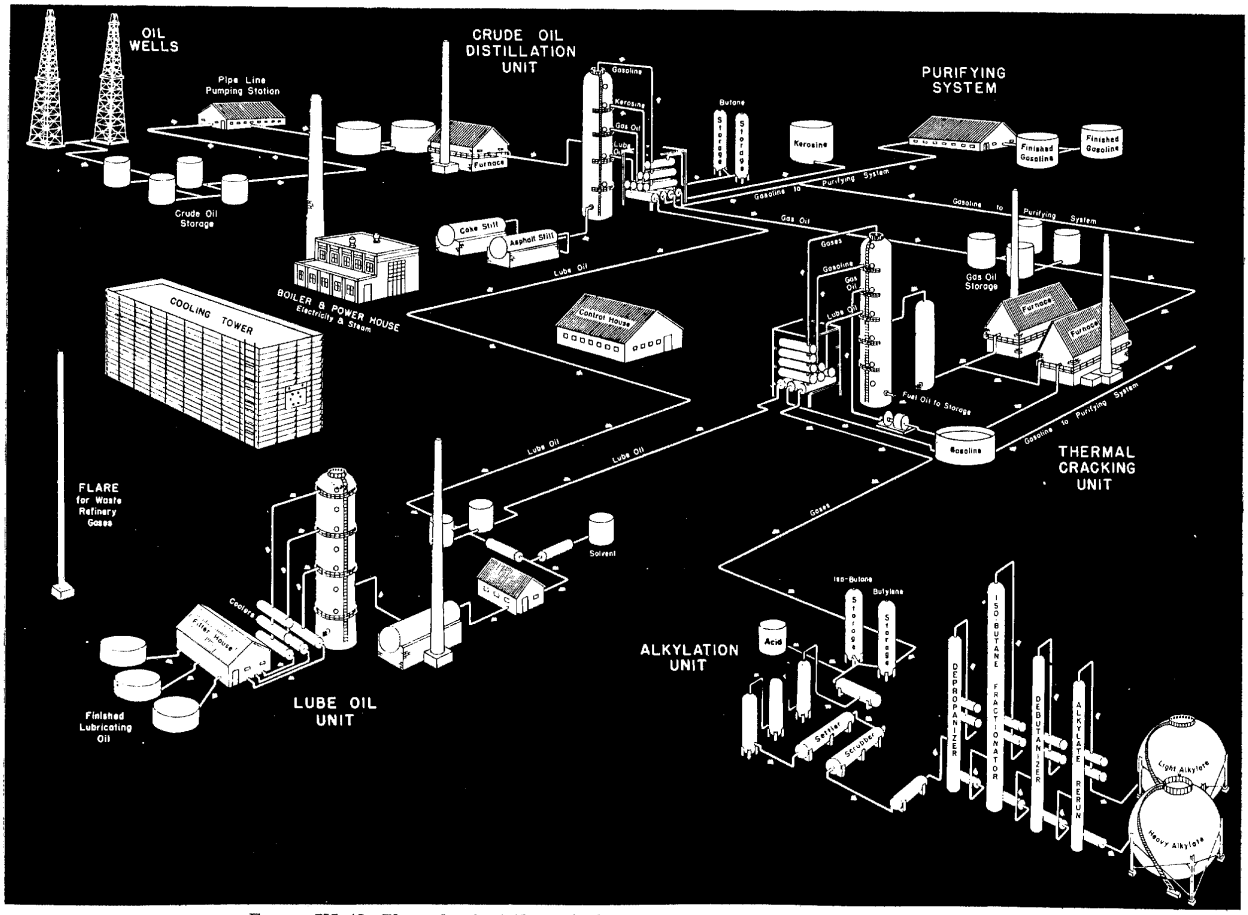


FIGURE IX-45. *Flow chart of the petroleum industry. Relative sizes approximate.*

equipment was lost and more was damaged due to unskilled dismantling, careless shipping, and pilfering of metal parts en route. Synthetic production cannot have reached significant proportions and with the Soviet Union's abundance of crude oil, there seems little necessity for erecting a synthetic fuel industry of major importance.

(c) Typical plant (FIGURE IX-45).—One of the most important petroleum refining plants in the USSR is the lend-lease Plant No. 3 at Kuybyshev. Its aviation gasoline refining equipment is sure to be copied widely in the Soviet Union. The plant is located 20 km. southwest of Kuybyshev, and 9 or 10 km. east of the Volga on the south side of the railroad line. Between the railroad and the plant are Soviet Air Force military barracks. When completed, the plant will cover one square mile. When current expansion is completed, its output will be 2,420 bbls. of 100-octane aviation gas per day, 10,450 bbls. of fuel oil daily, 430 bbls. of liquid propane per day, and 460 bbls. of butanepentane mixture. There are storage facilities for four months supply of crude oil. There are distillation units, a pipe still, and thermal and catalytic cracking units.

(d) Problems.—The problems of the Soviet refining industry are at present in a large part qualitative. The quality of products refined in the USSR is very low. Soviet industry does not have adequate lubricating oils of various grades and qualities, and consequently much resultant trouble with machinery. Soviet aircraft do not get adequate grades of high octane gasoline to give their best performance. During World War II, 2,159,336 short tons of American petroleum products were imported under lend-lease, including 590,484 tons of aviation gas over 99 octane; 122,415 tons of aviation gas over 87 through 99 and 19,690 tons of aviation gas 87 octane and under. The following discussion of the situation regarding products in Moscow is taken from the Soviet press as typifying the position of other important Soviet cities:

> The Neftegaz Plant in Moscow is said to be the only large enterprise of its type in the central Moscow region. It is in addition, one of the few refineries in the USSR with a complete cycle from processing of crude oil to processing of oil gas. Components for aviation gasoline are all obtainable at the plant. By the end of the Five-Year Plan in 1950 Moscow and Moskovskaya Oblast' will consume 600,000 tons of gasoline and other motor fuel in auto transport alone. It is uneconomic to transport this fuel from distant points. Refinery facilities near Moscow are therefore desirable since it is easier and cheaper to transport crude to Moscow from producing areas than to transport refined products. Besides the 600,000 tons of gasoline and other motor fuel for auto transport, the consumption of fuel oil and gas oil for boilers will reach one million tons, and the consumption of bitumen for Moscow roads will reach 100,000 tons per year, in addition to other demands for this product. Thousands of tons of lubricants are to be consumed each year in Moscow, yet no industrial lubricants are produced in Moscow or Moskovskaya Oblast'. Kerosene is not produced in the Moscow area in spite of the tremendous demand for it there. There are three oil refineries in the Moscow area which are completely obsolete and antiquated and only serve to pollute Moscow air.

The Five-Year Plan calls for the further development of high octane gasoline, improvement of the quality of other motor fuels and lubricants, and the development in the

USSR of catalytic refining in order to cut down the high waste now experienced in heating and refining crude oil.

A regulated transport for oil and petroleum products is of particular significance. The concentration of oil production in the Caucasus and the lagging behind of the new oil sources in the economic development of various regions in the USSR led to an increase in the average length of oil shipments. Average rail shipments amounted to 601 km. in 1913, 728 km. in 1928, 891 km. in 1932, and 1,228 km. in 1937. The measures under the third Five-Year Plan, which provided for accelerated development in the new oil fields located in areas far removed from the Caucasus, would have shortened the shipping distances. However, this would still not be sufficient to relieve railroad traffic, which must be further unburdened by a steady increase in oil transport by waterway and pipeline. The USSR stands far below the United States in the various methods of oil transport.

(5) Armament and munitions (FIGURE IX-66)

(a) Location (TABLE IX-56).—The Soviet armaments industry manufactures artillery, small arms, and small arms ammunition, while the munitions industry makes projectiles and explosives.

Before the war the armaments industry was distributed in the Moscow-Gor'kiy region; around Leningrad; in the Ukraine; in the Volga Valley; and in the Urals. The Tula region, south of Moscow, has long been known for its important gun factories. Production centered in areas where ferrous metallurgy and metal working was carried on for general industrial purposes with availability of materials and semimanufacturers, skilled management and labor, power, and transportation facilities. Wartime production figures show that evacuation of armament plants in the western part of European USSR must have been started as soon as the war commenced or even earlier in order to have been effected so rapidly.

The location of the munitions industry before the war is not clear, but it is known that one-third of the munitions factories were located in invaded or threatened areas and had to be evacuated and reinstalled during the war.

Relocation of arms plants was made on the basis of available plant space to the east. Arms and munitions production were given very high, if not the highest, priority. Rather than await the construction of new plants, less essential production was shouldered aside in existing factories and evacuated machinery was installed. As the Germans were pushed back from the Moscow-Tula region, production was restored in important plants which had been threatened but not overrun by the Germans. At Leningrad and Stalingrad, important plants were destroyed in the heavy fighting, but continued in partial production. In the Ukraine, little wartime restoration of German damage was possible, so complete was the German destruction.

(b) Production

1. SMALL ARMS PRODUCTION (UNDER 37 MM.) IN WORLD WAR II.—Official average annual production figures, 1942-44 for USSR, and estimates for European USSR are given in the tabulation on rifle, submachine gun, and machine gun production.

	USSR	EUROPEAN USSR	PERCENT OF USSR
Rifles	3,000,000	2,000,000	66
Submachine guns	2,000,000	1,500,000	75
Machine guns (light and heavy)	450,000	300,000	66

2. ARTILLERY AND MORTAR PRODUCTION IN WORLD WAR II.—Soviet official average annual production figures, 1942-44, for USSR and estimates for European USSR are shown in the tabulation on gun (including AAA and aircraft cannon) and mortar production.

	USSR	EUROPEAN USSR	PERCENT OF USSR
Guns, including AAA and A/C cannon	120,000	60,000	50
Mortars	100,000	75,000	75

Estimates of monthly production of artillery pieces by calibers, early 1945, are shown in the tabulation on gun and howitzer production.

	USSR	EUROPEAN USSR	PERCENT OF USSR
57-mm. guns	670	335	50
76-mm. howitzers, M1943	200	100	50
76-mm. guns M1942	2,320	1,160	50
122-mm. howitzers, 1938	480	240	50
100-mm. guns, M1944	100	50	50
152-mm. howitzers	300	150	50
76-mm. tank guns	600	300	50
85-mm. tank and SP guns	1,500	740	50
100-mm. tank and SP guns	50	25	50
122-mm. tank guns	300	150	50
152-mm. SP gun-howitzers	130	65	50
203-mm. howitzers	40	20	50
210-, 280-, and 305-mm. howitzers	40	20	50

Peak monthly production of 45-mm. AT guns, reached in 1944, is estimated as 3,000 for the USSR as a whole, of which 1,500, or 50%, were manufactured in European USSR.

These wartime estimates appear somewhat low in the light of Stalin's figures of 9 February 1946, but are the best available at present. Whenever possible, these estimates have been checked with the meager data on armament output in Soviet publications, and with the views of the few Allied observers who have visited Soviet defense plants.

3. ROCKET LAUNCHER AND ROCKET PRODUCTION IN WORLD WAR II.—A German estimate of Soviet rocket production for early 1945 was 52,200 monthly. If this somewhat high German figure is accepted, it is probable that 40,000, or 77%, were manufactured in European USSR.

4. EXPLOSIVE DEVICE PRODUCTION IN WORLD WAR II.—Estimated production of Soviet explosive devices for 1944 is shown in the tabulation on bomb and hand grenade production:

	USSR	EUROPEAN USSR	PERCENT OF USSR
Bombs	3,200,000	1,600,000	50
Hand grenades	2,700,000	2,000,000	74

No figures are available on the production of mines, booby traps, fuzes, and igniters.

5. MISCELLANEOUS DEVICE PRODUCTION IN WORLD WAR II.—No information is currently available on the production of flame throwers, pyrotechnics, chemical projectors, or the like.

6. AMMUNITION PRODUCTION IN WORLD WAR II.—Official production figures for 1944 were supplied by Stalin on 9 February 1946; estimates for European USSR are shown in the tabulation on cartridge and ammunition (including bombs and rockets) production:

	USSR	European USSR	Percent of USSR
Cartridges	7,400,000,000	4,400,000,000	60
Ammunition (including bombs and rockets)	240,000,000	120,000,000	50

An approximate breakdown of mortar and artillery ammunition production for 1944 is shown in the tabulation on mortar and artillery shell production:

	USSR	European USSR	Percent of USSR
Mortar shells:			
50-mm.	19,500,000	9,750,000	50
82-mm.	39,000,000	19,500,000	50
120-mm.	19,500,000	9,750,000	50
Total	78,000,000	39,000,000	
Artillery shells:			
45-mm. and 57-mm.	59,000,000	29,500,000	50
76-mm.	78,000,000	39,000,000	50
122-mm.	19,000,000	9,500,000	50
Total	156,000,000	78,000,000	

(c) Plants and products

TABLE IX - 56

ARMAMENTS AND MUNITIONS PRODUCTION AND LOCATION, BY OBLAST, EUROPEAN USSR

Location	Number of plants	Products
North-Northwest:		
Karelo-Finnish SSR	1	Ammunition.
RSFSR:		
Arkhangel'skaya O	4	Rifles; heavy MGs; mortars; depth charges; blanks for gun barrels; MG parts.
Komi ASSR	1	AT Guns; small arms.
Leningradskaya O	65	Small arms; mortars; rocket launchers; 45-mm to 203-mm artillery; AT, AA, aircraft and mountain guns; machine guns for field and aircraft use; parts for these weapons and ammunition for them; also grenades, bombs, fuzes, torpedoes and rockets; land and sea mines; bomb releases; AA directors; demolition charges; detonators; ammunition boxes; knives, bayonets, and swords.
Murmanskaya O	5	Artillery and mortar shells; bombs; grenades; torpedo landing; gun repairs; 120-mm mortar mfg.
Vologodskaya O	2	Ammunition.
West:		
Latvian SSR	1	Small arms and artillery parts.
South:		
Ukrainian SSR:		
Dnepropetrovskaya O	1	Ammunition.
Kkar'kovskaya O	2	Mortar industry.
Kiyevskaya O	3	Mortar industry; grenades; 76-mm ammunition.
Odesskaya O	1	Mortar ammunition.
Stalinskaya O	1	Mortar industry.
Sumskaya O	1	Mortar industry.
Voroshilovgradskaya O	2	Artillery and artillery ammunition; hand grenades; explosives.
South: *(continued)*		
Zaporozhskaya O	1	Mortars.
Southeast:		
RSFSR:		
Rostovskaya O	3	Mortar industry; artillery and artillery ammuntion.
Volga:		
RSFSR:		
Astrakhanskaya O	4	Bomb fins; bombs; 122-mm shells; mortar ammunition; hand grenades; rifles; artillery shells; small arms parts.
Chuvash ASSR	4	Ammunition boxes; repair of artillery and small arms; AT rifles; powder; fuzes; demolition blocks; rifle barrels; bombs; grenades; tracer ammunition.
Kuybyshevskaya O	15	Detonators, fuzes, explosives; shell filling; aircraft MGs; 82-mm mortar ammunition; rockets; primers; rifles; mortars; heavy MGs; guns; cartridge cases; grenades; MG mounts; mortar shells; 20-mm and heavy AA guns; MGs; 45-152-mm artillery grenades; bomb parts; artillery ammunition; smoke apparatus; ammunition loading; reconditioning of cartridges and shell cases; fuzes.
Mari SSR	1	Machine gun parts and mounts.
Saratovskaya O	13	Artillery shells; 122- and 203-mm shells; 45-mm sub-caliber shells; AA shells; bombs; 120-mm mortars; automatic pistols; AT rifle ammunition; MG, AT, and small-arms ammunition; land mines; machine psitols; 45-mm shell loading; small arms; hand grenades; MGs; ammunition loading.
Stalingradskaya O	9	Small arms; 45-406-mm artillery; tank and AT guns; mortars to 160-mm; rocket projectors; mortar shells; artillery ammunition; bombs, including concrete bombs; shell finishing and loading; hand grenades; cartridges and clips.
Tatar ASSR	7	82-mm mortar ammunition; grenades; 45-205-mm shells; detonators; small-arms ammunition; hand grenades; rifle ammunition; ammunition boxes; AA, AT shell cases; 75- and 76-mm shells; 250-kg bombs.
Ul'yanovskaya O	4	Pistol, rifle ammunition; 45-, 57-, 152- and 203-mm shells; tank guns; cartridges; machine pistols.
Central Industrial:		
RSFSR:		
Gor'kovskaya O	19	Machine pistols; automatic rifles; parts for all types of guns; AA; MGs; 20-mm artillery and ammunition; hand grenades; rocket projectors and rockets; mortar shells; fuzes and detonators; torpedoes; sea mines; small arms ammunition; shell cases; munitions; 45-mm AT shells; 50-120-mm mortar ammunition; MGs.

TABLE IX - 56 (Continued)

Location	Number of plants	Products
Central Industrial: (*continued*)		
RSFSR: (*continued*)		
Ivanovskaya O.....	11	MG drums and submachine gun magazines; MG, rifle and submachine gun ammunition; 76-mm AA ammunition; fuzes; 50-kg bombs; mortars and shells; hand grenades; 45-152-mm artillery ammunition; detonators; rotating bands; cartridge cases; automatic rifles; machine pistols; MGs; AT rifles and guns; 122-mm shell cases; MG and rifle parts; AT guns.
Kalininskaya O.....	11	Rifles; MGs; 76-mm propaganda shells; bombs; rocket guns; shells; rifle ammunition; 50-120-mm mortar shells; 152-mm howitzer recuperators; machine pistols; submachine guns; rifles; revolvers.
Kostromskaya O.....	1	50 and 82 mm mortars.
Mordovian ASSR.....	1	152-mm shells and larger; 75-kg bombs.
Moskovskaya O	104	Small arms; mortars; rocket launchers; 45-203-mm artillery; MGs for field and aircraft use; parts for these weapons and ammunition for them; grenades; bombs; fuzes; rockets; land and sea mines; bomb racks and releases; detonators; ammunition boxes; incendiary and tracer ammunition; smoke grenades; primers; 8-kg armor-piercing mines; depth charges; explosives; SPEZ cartridges; tread mines; AA directors; rocket launchers and guns; non metallic mines and parts; time fuzes for mines; 76-mm grenades; torpedo tubes; flame throwers.
Penzenskaya O.....	1	45-mm AT shells; cartridges; artillery and mortar shells; bombs; "Katyusha" rocket guns; mortars; 45-152-mm artillery; AA guns; small arms; MGs; land and sea mines; bomb and shell fuzes; detonators; black powder; bombs; torpedoes; weapons.
Ryazanskaya O.....	2	AA ammunition; bombs; munitions.
Tambovskaya O.....	5	Bombs; 122-152-mm shells; dynamite and powder; hand grenades; land and sea mines; 122-mm shells.
Tul'skaya O.....	8	Pistols; rifles; revolvers; sub-caliber small arms; submachine guns; light MGs; heavy MGs; semi automatic rifles; automatic rifles; 37-mm guns; small arms; MG and artillery ammunition; bombs; armor-piercing, incendiary, and tracer ammunition; primers; detonators; shell cases; shell filling.
Vladimirskaya O.....	7	Detonators; fuze parts; cartridge cases; automatic rifles; machine pistols; light MGs; heavy MGs; AT guns; bombs; AT rifles; mortars; 50 and 82-mm mortar shells; 122-mm shell cases; 45-mm shells; cartridges; mines; 45-mm AT guns; MG and rifle parts; artillery shells.
Voronezhskaya O.....	6	Pistols; revolvers; 50-120-mm mortars and shells; incendiaries; 75-100 kg bombs; light bombs; aerial mines.
Yaroslavskaya O.....	17	Pistols; MGs; 50-120-mm mortars; submachine guns; artillery; 45-203-mm shells; small-arms ammunition; 8-kg and 500-kg bombs; sea mines; land mines; gun breeches; bomb releases; hand grenades; gun wheels; springs; brass fittings; gun breeches; weapons repair; projectiles; time fuzes for bombs; MG parts.

(d) Typical installation.—So urgent was the need for arms and munitions in 1941 that virtually every large factory in the land converted some or all of its facilities to their production, not to mention a great many small machine shops of various types. A mirror factory in Kalinin turned to making propaganda shells; a potato masher factory at Semënev (Gor'kovskaya Oblast') made hand grenades; the great automobile plants at Moscow, Yaroslavl', and Gor'kiy continued to produce motor vehicles, but turned out mortars, shells, and small arms in some of their departments. The range of manufactures entering the category of armament and munitions is so wide that nearly all types of plant, are represented, from local woodworking shops turning out non-metallic antipersonnel mines and ammunition boxes, through various chemical establishments manufacturing powder and explosives and almost the full range of metalworking establishments from Sovkhoz (state farm) tractor repair shops to metallurgical giants. Even textile, rubber, and ceramics plants contributed parts for projectiles or weapons. Despite the variety of plants involved, an armaments plant and a munitions-making installation will be discussed briefly.

The Mytishchi plant, just northeast of Moscow, was converted from peacetime production of railroad cars, subway cars, and street cars to mixed production of railroad cars; self-propelled assault guns; 50- and 100-kg. bombs; 85-kg. antipersonnel bombs (March 1943: 200-300 daily); 250-kg. antipersonnel bombs (March 1943: 500-550 daily); 150-kg. depth charges (March 1943: 700-720 daily; Katyusha rocket shells (March 1943: 550 daily); and F-1 hand grenades. The plant was partially evacuated to Katav-Ivanonsh in 1941, but returned at the end of 1942.

Factory buildings cover an area of about 6,750,000 square feet, of which nearly 1,000,000 square feet is built-up area. The plant area is divided by the river Yausa and bordered on the west by the Moscow-Alexandrov R.R., to which it is connected by extensive plant trackage. (See tabulation for elements of the installation, with approximate ground area covered.)

Elements of Mytishchi Plant	Square Feet
Foundry (including 2 Vegranka furnaces of 6 tons each, 2 converters of 6 tons each)	22,500
Forge	14,850
Electric welding shop	64,800
Oxygen welding shop	45,000
Mechanical Dept. 15	38,700
Mechanical Dept. 16 and Admin.	49,500
Assembly shop	27,000
Experimental and shops	234,000
Assembly Dept. No. 5	172,800
Water tower	----
Press forge	43,200
Scrap pile	16,200
Equipment warehouse	27,000
Castings storage	19,800
Construction Dept.	16,200
Sandblasting Dept.	2,160
Pumping station	11,700
Oxygen plant	3,240
Carpentry shop	32,400
Electric sub-station (of Kashira Station)	800
Boiler house	27,000
Storage sheds	30,240
Drafting office	19,800
New building	58,500
Total	977,390

A shell-loading plant is located at Buzhaninovo (Moskovskaya Oblast'), nine miles northeast of the center of the city of Zagorsk. During the war this plant manufactured ammonite and ammonal (3 Dec. 1941, 50 kg. daily) explosive; demolition blocks of 2-48 kg.; 25-500 kg. incendiary bombs; tracer ammunition; (Dec. 1941: cal. 7.6 mm. 5 to 6 million monthly, cal. 20-mm. 40,000 monthly); antitank grenades; infantry ammunition; ammunition of all types (cal. 45 mm. 70,000 monthly); percussion caps; projectiles; "Par 13" flares with parachutes (Dec. 1941: 2,000 daily); "DM-11" smoke shells (30,000 to 40,000 monthly); plywood antipersonnel mines (detonators from plant No. 57, Moskva, 3,000,000 daily); 25-500 kg. bombs; hand grenades (4,000 daily); primers; antipersonnel mines.

The loading plant for hand grenades and tracer ammunition was evacuated to Cheboksary in October-November 1941; subsequently the plant was reequipped at its present site.

Buildings of the munitions plant are widely scattered and either heavily camouflaged or constructed underground. Loading operations are conducted underground and bad ventilation in similar Soviet plants has led to a high turn-over of labor. There is a power station at the plant, and sidings connect with the Moscow-Arkhangel'sk railway line. A typical ammunition plant is located in a deeply wooded area and even though the approximate location of this installation is known, it would be difficult to locate and destroy.

(e) Special problems.—In 1940 the major artillery, small-arms, and ammunition plants of the USSR were located in regions which were occupied by the Germans in 1941, or so directly threatened as to necessitate evacuation. Much evacuation was effected to the Volga region. The following year much of the armament and munitions industry was brought back to its original location. For this there were three reasons: 1) a great part of the most skilled industrial workers of the Soviet Union were located in the Leningrad-Moscow-Tula-Gor'kiy areas; 2) these areas were merely threatened, and not actually occupied by the Germans, so that damage was largely limited to the effects of German bombing; and 3) the limited Soviet transportation facilities placed a high premium on production of munitions near the front. Reclaimed and imported metal was utilized as raw material. In most cases, cadres remained on the old sites when industries moved eastward, and in many cases additional cadres remained in the east when the bulk of the machinery of a plant was returned to its original site. Production in the Central Industrial Region was stimulated by the use of second-hand machinery from damaged areas, and in 1943-45 new machine tools were produced by factories in European USSR and the Urals.

Inasmuch as conversion was effected with great suddenness during the war, similar rapid conversion may be expected if another national emergency occurs.

Within 15 years, enough Soviet armament and munitions plants to support a war could be placed underground in European USSR, and this trend must be expected. A marked tendency toward decentralization of industry characterizes the fourth Five-Year Plan, together with the restoration of the South and White Russia, forced development of the Newly Incorporated Territories, and dispersal of established concentrations of arms and munitions plants.

(6) Shipbuilding

(a) Location of industry (Table IX-57).—The major shipyards of the USSR are located in Leningrad, Molotovsk, Nikolayev, Odessa, Sevastopol', and Komsomol'sk-na-Amore. All but the last named are located in European USSR. Leningrad, the oldest shipbuilding center, was also the largest, and the majority of the Soviet's large ships were built there before the war. Plans had been drawn up for the expansion of both the Molotovsk and Nikolayev yards, but the outbreak of the war prevented the execution of these plans. It was intended to make Molotvsk the largest yard and 80,000 to 100,000 people were ultimately to be employed. By 1941, the yard was one-fourth completed and there were about 14,000 employees. At the Marti Shipyard in Nikolayev, considerable expansion had also occurred and the yard was planning to employ 40,000 people in a few years. A battleship was under construction but was not completed because of the war. In addition to these main yards there are numerous smaller construction and repair yards in the area covered by this study. The location of the major yards is shown on Figure IX-66.

(b) Production (Table IX-57).—It is not possible to give any over-all production figures for the Soviet Union or for European USSR. The lack of information makes it difficult to evaluate properly the efficiency of the Soviet yards. Under the prewar Five-Year Plan shipbuilding was emphasized and production steadily increased. In 1921, the USSR had only 200,000 tons of merchant shipping, but by 1941, the United States Maritime Commission estimated that the Soviet merchant fleet consisted of 1,120,138 gross register tons. In the 1920's the Soviet yards were very inefficient and ship construction time was at least double that in other nations. During the 1930's striking improvements were made in the operation of the yards and the output increased in proportion. However, the Soviets continued to rely on foreign builders for designs, and repair facilities remained inadequate and inefficient.

At the outbreak of the war, 2 battleships (35,000 tons each), 9 cruisers, and 16 sea-going merchant vessels were under construction in European USSR. Some of the merchant ships may have been completed, but it is believed that all work stopped on warships. During the war, the majority of the yards built small naval vessels, tugs, and barges, and repaired all types of ships. Since the end

of the war, the Soviets have devoted much time and money to the restoration of damaged yards and to salvaging of destroyed and sunken ships.

Greatly increased shipbuilding in the Soviet Union is planned for the next few years. The fourth Five-Year Plan has set up the following goals: a 100% increase in shipbuilding, including 400,000 tons of maritime shipping, and a 150% increase in repair facilities.

Additional shipbuilding and repair facilities are to come from foreign sources. Soviet shipbuilding equipment is reportedly being increased (doubled according to one source) by the removal of shipyards from Germany, as reparations. Some repair yards in Finland and Rumania, under terms of treaties between the USSR and these countries, are to repair Soviet ships for the next five years.

TABLE IX - 57

SHIPBUILDING PRODUCTION AND LOCATION, USSR

Part A

Place	Yard	Facilities
Leningrad...	Marti shipyard....	A drydock, 2 slipways 180 meters long and 2-3 slipways about 100 m. long. Submarine construction spaces but without launching facilities.
Leningrad..	Serge Ordzhonikidze, Baltic Shipbuilding yard.	A drydock, 7 shipways (one 250 meters and one 200 meters long) 6 building spaces.
Molotovsk..	Shipyards Nos. 402 and 33.	Drydock for very large ships, one covered-in slip building two 10,000-ton ships, 10 parallel ways.
Nikolayev..	Marti shipyard....	9 shipways, four over 400 meters, one over 200 meters long, two slightly smaller, 6 small shipways for traverse launching. A 35,000-ton floating dock, 2 drydocks 80 and 100 meters long.
Nikolayev..	Russud shipyard...	Two shipways, 200 and 160 meters long, one traverse shipway.
Odessa.....	Marti shipyard....	2 shipways, one 66 meters long and one 69 meters, 5 floating cranes, a 2,000-ton floating dock, two other docks, one of 6,000-ton and one of 4,000-ton capacity.
Sevastopol'.	Sevmor Zavod Navy Yard.	2 drydocks, one 207 meters long, one 152 meters long, a 4,200-ton capacity floating dock, a 30,000-ton floating dock on north side of yard, 5 shipways.

Part B

Civil division	Number of yards	Production
North and Northwest:		
RSFSR:		
Komi ASSR.....	2	Mfg. spare parts for ships, repair of small ships.
Arkhangel'skaya O...	15	Construction of ocean-going passenger ships, ice-breakers, destroyers, submarines, subchasers, small merchant ships, 2,800-hp. tugs, light and medium cutters, motorboats, fishing vessels; ship structural steel; repair of war vessels, merchant vessels, and all type small craft.

TABLE IX - 57 (Continued)

Part B (Continued)

Civil division	Number of yards	Production
RSFSR (Continued)		
Leningradskaya O...	33	Construction of cruisers, battleships, destroyers, submarines; freighters, tankers, ice-breakers, lighters, sloops, trawlers, dredges, cranes, small minesweepers, torpedo boats, river boats, ships' engines, boilers, armor plate, castings, fittings, turbines; repair of all the above types of ships.
Murmanskaya O.....	5	Construction combat ships smaller than destroyers, small passenger ships, fishing boats, repair sea-going passenger vessels, tankers, large ice-breakers, minesweepers.
Novgorodskaya O....	1	To become a center of river-craft production.
Vologodskaya O.....	5	Build small steamers, barges up to 1,500 tons, wooden barges, tugs, repair of river paddle-wheel boats and other tugs.
Karelo-Finnish SSR....	4	Construction of ships up to 1,000 tons, ships of up to 600 tons with 500 hp. diesel engines, river boats, tugs, fishing boats, repair of ocean-going vessels, tugs.
West:		
RSFSR:		
Kaliningradskaya O..	1	Mfg. of river boats up to 1,300 tons, minesweepers, aircraft tenders; mfg. of castings.
Estonian SSR.....	5	Repair of merchant ships, cruisers, destroyers, and other naval vessels, and ship engines.
Latvian SSR.....	10	Construction of seagoing tugs, repair of small vessels, boilers, fittings; outfitting of merchant and naval vessels, and small ships; engine repairs.
Central Industrial:		
RSFSR:		
Gor'kovskaya O.....	18	Construction of Volga steamers, submarines, river tankers, tugs, tow boats, cutters, motor sleds; steam engines, lighters, tug boat tools, boilers, fittings, cylinders, castings, shipbuilding plates, electric equipment for submarines, parts for motor boats, repairs all types of Volga river boats.
Ivanovskaya O.....	5	Construction of assault boats, barges, tug boats, wooden Volga boats, hulls, wooden pontons, boilers, repair barges and other river boats.
Kalininskaya O.....	2	Construction of river boats, barges, and fishing craft, repair of paddle steamers.
Kirovskaya O.....	3	Construction and repair of river boats, repair of tugs and fishing vessels.
Moskovskaya O.....	7	Construction river boats, motorboats, fishing vessels, diesel engines, turbines, pumps, armor plate, aluminum ships' sections, experimental models for navy.

TABLE IX - 57 (Continued)

Part B (Continued)

Civil division	Number of yards	Production
RSFSR (Continued)		
Ryazanskaya O.....	1	Repair of ships used on Kanal Moskva-Volga.
Tambovskaya O.....	1	Built subchasers only during the war. Believed to be building fishing vessels, river tugs, and other river craft now.
Tul'skaya O.....	1	Unspecified ship repairs.
Yaroslavskaya O.....	5	Construction of cutters, tug boats, reinforced concrete grain ships, wooden Volga boats, wood and steel motorboats, repair of steam tugs and freighters, and passenger ships.
Mari ASSR.....	3	Construction of single deck passenger ships, up to 280 hp. and diesel tugs up to 540 hp. wooden barks and tugs, and of shipbuilding materials, overhaul of up to 50 freight boats per winter.
Urals:		
Bashkir ASSR.....	1	Repair of river steamers.
RSFSR:		
Molotovskaya O.....	9	Construction of river boats, small steamships, propeller shafts, steamships armor plates, parts of shipbuilding, dredges, cranes, steam engines up to 200 hp., ships' sections, fittings, castings, oil refrigerators for submarines, repair river boats, tugs, fishing vessels.
Udmurt ASSR.....	3	Construction of river boats, fishing vessels and parts for ships' engines, motorboat engines, boilers, parts for river steamers and gun boats.
Volga:		
Tatar ASSR.....	6	Construction of small river boats, fishing vessels, tugs, motorboats for the Caspian fleet, standardized parts for speed boat motors, motor torpedo boats, and submarines, wooden sections of ships, repair of Volga tankers, other river boats, turn-screw speed boats, subchasers during the war.
RSFSR:		
Astrakhanskaya O...	11	Construction of tugs, tankers, freighters, passenger ships, ice-breakers, fishing vessels, diesel engines, ships' sections, fittings, castings, plates, repair tankers up to 6,000 tons, vessels of Baku-Astrakhan line, dredges, mud scows, house boats, all types of Volga boats, ships of the Volga-Caspian trust.
Kuybyshevskaya O..	7	Construction of 480-hp. tugs, river boats, ships' engines, parts for submarines, repair of passenger ships, tugs, barges.

TABLE IX-57 (Continued)

Part B (Continued)

Civil division	Number of yards	Production
RSFSR (Continued)		
Saratovskaya O.....	7	Construction of passenger steamers, diesel tugs, freight barges up to 6,000 tons, tankers, refrigerator ships, all metal freight motorboats, mud scows, diesel parts, ships' sections, castings and fittings, repair of submarines, river boats, liners, lighters, tugs, barges, landing bridges, and unpowered wooden vessels, diesel engine mfg.
Stalingradskaya O...	11	Construction of freighters, tugs, all metal and small wooden boats, boilers, armor plates, repair of river boats of all types. Stalingrad was repair center for vessels of Volga fleet during fighting around Stalingrad.
South:		
RSFSR:		
Krymskaya O.....	4	Construction of destroyers, torpedo boats, submarines, repair of capital ships, cruisers, tankers, ocean steamers, outfitting of warships.
Ukrainian SSR:		
Dnepropetrovskaya O.	1	Construction of armor plate, ships' sections, fittings, castings.
Khar'kovskaya O....	2	Diesel engines for ships.
Khersonskaya O.....	3	Construction of freighters, diesel tug boats, floating docks, drydocks, torpedo and river boats, concrete ships, repair of submarines and other combat ships smaller than destroyers.
Kiyevskaya O.....	4	Construction of diesel boats and tugs, freighters and passenger steamers, river tankers, ships' engines, boilers, ships' equipment, small warships and barks, repair of merchant and naval ships.
Nikolayevskaya O...	5	Prewar capacity was 40 submarines, 4 destroyers, 3 cruisers, yearly and an unspecified number of ice-breakers, freighters, tankers, tug boats, river boats, boilers, fittings, castings. During war, construction was limited to tugs, small troopships, and repair of all types of ships; motor torpedo base, repair shop.
Odesskaya O.....	3	Construction of small war vessels, submarines, repair of submarines, freighters, tankers, and warships.
Stalinskaya O.....	3	Construction and repair of merchant ships, boilers, repair of destroyers and smaller warships, ocean passenger ships, tankers, and ice-breakers.
Zaporozhskaya O....	2	Construction and repair of merchant vessels.
Southeast:		
RSFSR:		
Rostovskaya O.....	5	Construction of cutters, corvettes, tugs, sea-going merchant ships, repair of tankers, ice-breakers, repair of destroyers and smaller warships.

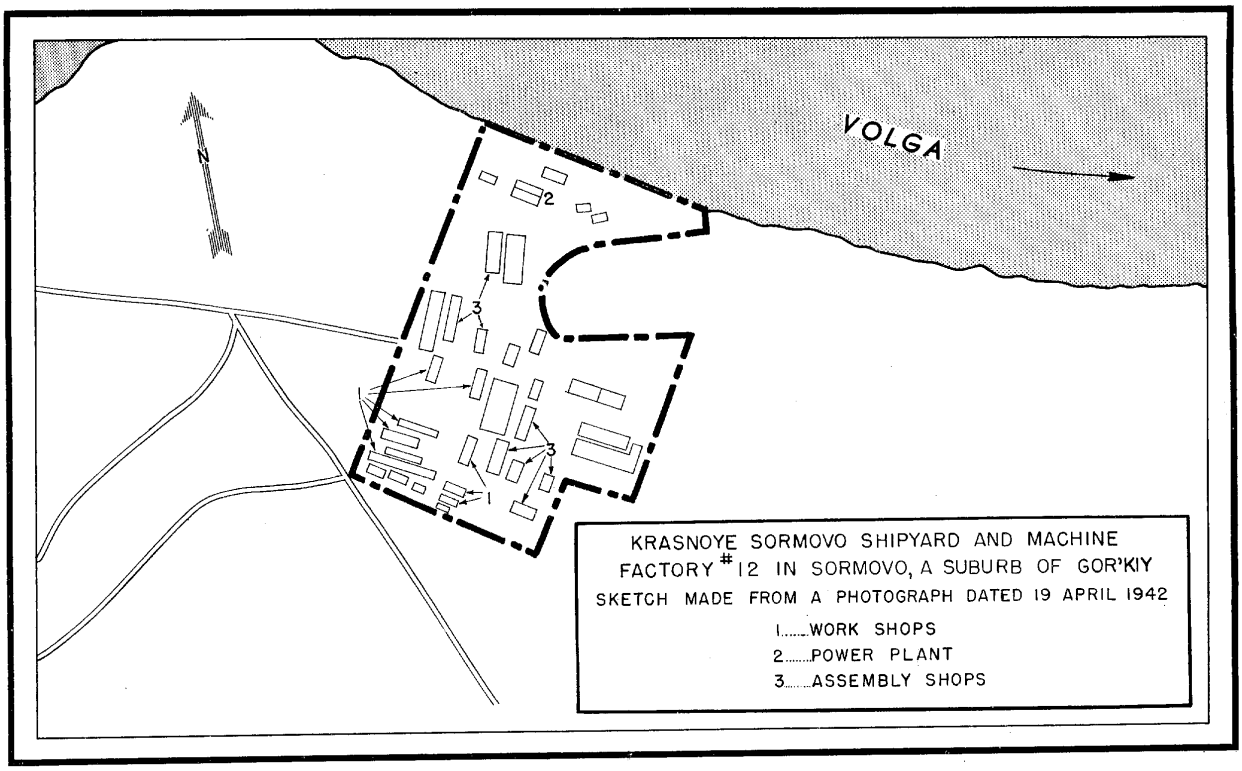


FIGURE IX-46. *Shipyard and Machine Factory No. 12, plan, Gor'kiy. April 1942.*

(c) Typical installations.—The shipbuilding yards vary greatly in equipment and production, but an important inland yard and one of the large Leningrad yards are described as somewhat typical of the larger installations.

The Krasnoye Sormovo Shipyard and Machine Factory No. 112 at Sormovo, a suburb of Gor'kiy, is one of the more important inland yards (FIGURE IX-46). Equipment includes 20 shipways, a dock for submarines, open hearth furnaces, an iron foundry, rolling equipment, and a drop forge. At one time this factory turned out locomotives, but between 1934 and 1937 the locomotive building facilities were converted to submarine production. From 1937 to 1941, the yard built passenger steamers, tugboats of all types up to 1,400 hp., barges up to 12,000-ton capacity, river tankers, submarines and other combat ships, marine propeller shafts, and steering mechanisms. After the outbreak of the war, the plant turned out 3 submarines and 150 army medium tanks a month. It overhauled and repaired motor torpedo boats, submarines, gunboats, river steamers, tugboats and barges, as well as American and British tanks. It also manufactured artillery ammunition. The number of workers increased and was estimated to be between 20,000 and 25,000 working in three shifts in 1943. After 1944 the plant resumed production of all types of river boats and barges.

The Serge Ordzhonikidze Baltic Shipbuilding Yard at Leningrad, built 91 years ago, was the largest Soviet yard before the war (FIGURE IX-47). Equipment included a drydock and seven shipways—one 200 meters long with three stationary 15-ton cranes, one 250 meters long with two stationary 15-ton cranes, three shipways for destroyers and submarines, with 15-ton rail cranes, and two traverse shipways for torpedo boats. There are six building spaces with traverse launching facilities for destroyers, one 35-ton rail crane, a power plant, foundry and galvanizing shops, a machine construction loft with testing facilities, an outfitting quay, and a forge and welding shop. Before the war, this yard built battleships, cruisers, destroyers, freighters, tankers, large ice-breakers, turbines, diesel and steam engines, ships' boilers, and steel castings. Twenty-nine thousand workers in three shifts were employed there in 1938. During the war, this yard built destroyers, minesweepers, engines, and small vessels and repaired all types of ships. A portion of the yard was evacuated to Sverdlovsk in 1941. The equipment remaining in Leningrad subsequently suffered heavy bomb damage.

(d) War damage and effects.—All the major construction yards in European USSR, except Molotovsk, were damaged or destroyed during World War II. The Leningrad yards suffered heavily from ground and air attack. Nikolajev, Odessa, and Sevastopol' were occupied by the Germans and held until 1944. The Molotovsk yard was subjected to air attack but received very little damage. Many other yards were heavily damaged and a considerable number were destroyed. In addition to the damage done by the Germans during attacks, the Soviets destroyed many yards before they evacuated, and then the Germans, in turn, removed equipment to Germany as they retreated.

The yards which escaped damage were forced to cease constructing large ships and turned to construction of small naval and river ships, and to the repair of all types of boats. Some inland yards were able to increase production as evacuated equipment and workers were sent to the interior. Most yards appear to have been able to obtain sufficient employees but had to hire large percentages of women and children. Conversion to warship production was not particularly difficult in Soviet shipyards. Many

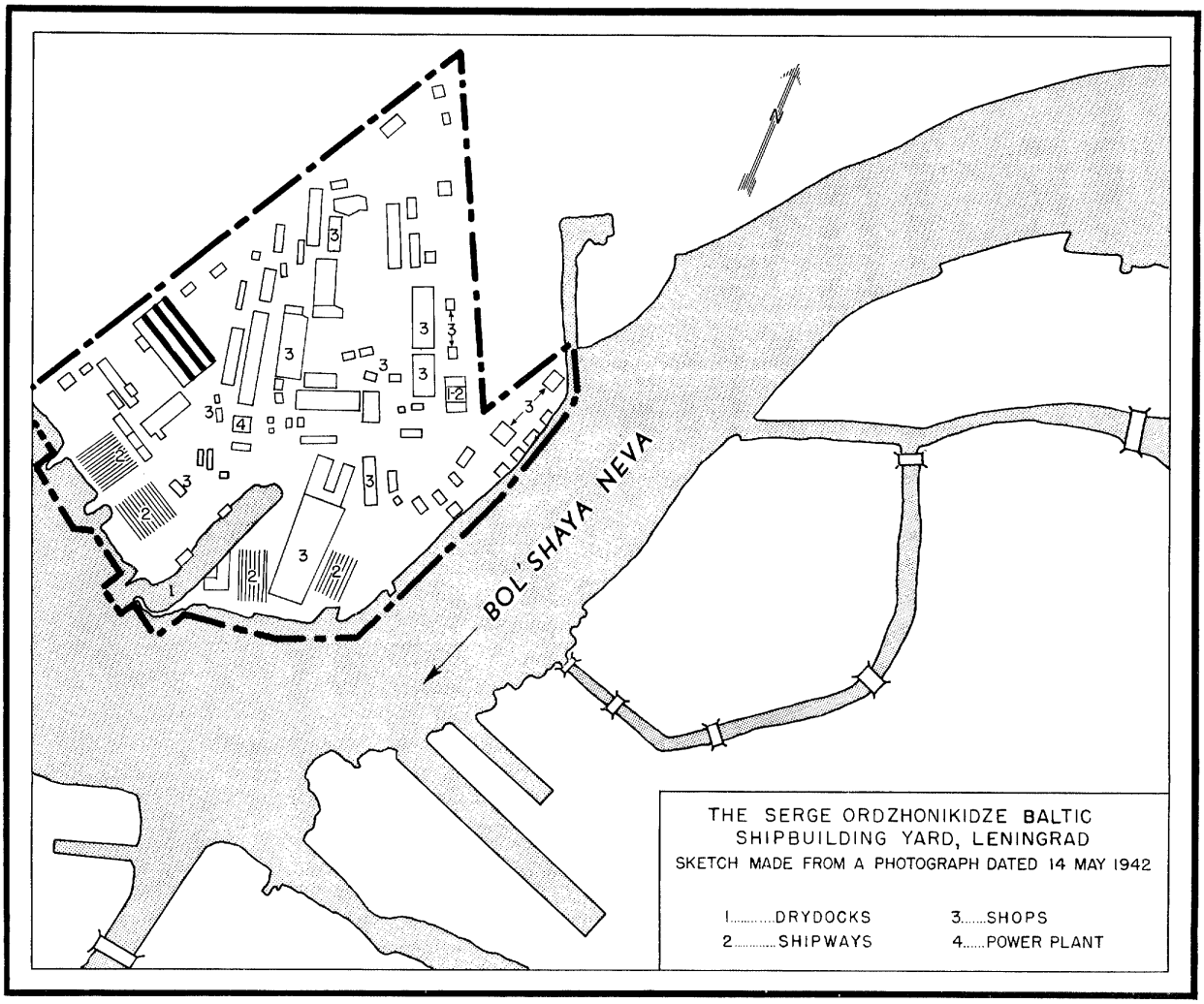


FIGURE IX-47. *Shipyard, plan, Leningrad. May 1942.*

yards had produced naval as well as merchant ships and they increased the production of naval shipping and stopped or decreased production of merchant types. Other yards which had built launches, steamboats, and other river boats converted to production of motor torpedo boats, corvettes, cutters, motor sleds, and minesweepers. In addition, many yards increased their production of armor plating and of castings and fittings. A few yards produced and repaired army medium tanks, and some manufactured ammunition, but the majority concentrated on shipbuilding and repair.

The fourth Five-Year Plan specifies that the Soviets are to completely rebuild all war-damaged shipyards by 1950. Non-Soviet observers agree that this is possible if the proper machinery is available.

(7) Aircraft

(a) Location.—The aircraft industry in European USSR is concentrated in five cities—Moscow and the four Volga river cities of Gor'kiy, Kazan', Kuybyshev, and Saratov. TABLE IX-58 contains estimated annual production rates in these cities of airframes and engines with proportion of national production accounted for by each.

TABLE IX-58

AIRCRAFT PRODUCTION BY MAJOR AREAS

	Airframes per year *		AC engines per year	
	Number	*Percent*	*Number*	*Percent*
Gor'kiy	5,520	10.0	3,600	4.8
Kazan'	5,500	10.0	8,400	11.1
Kuybyshev	9,600	17.5	16,800	22.2
Moscow	6,480	11.8	7,800	10.3
Saratov	3,600	6.6	....	....
European USSR	30,700	55.9	16,800	48.4
USSR total	54,750	100.0	75,600	100.0

* Based on production during period January to April 1945.

Aircraft production at each of these cities is associated with satellite complexes of subassembly and components plants. Engine production at Kazan' (FIGURE IX-48), Kuybyshev, and Moscow is sufficient to supply local airframe plants. At Gor'kiy, engine production is insufficient and engines are probably shipped from Kazan' and Kuybyshev. There is no engine production at Saratov which is undoubtedly supplied from Kuybyshev where there is considerable excess engine production. Some engines un-

TABLE IX - 59

PRODUCTION AND LOCATION OF AIRFRAME PLANTS

Place	Last A/C types produced		Pre-VE Day * maximum annual output rate	Remarks
South:				
Khar'kov	.....		.....	Destroyed in war. Being reestablished in 1944.
Khar'kov	.....		.....	New plant in 1944. Possibly A/C assembly.
Poltava	.....		.....	New plant in 1944. Possibly A/C assembly.
Volga:				
Dolgoprudnyy	.....		360	Assembled several types at different times.
Kazan'	PE-2	TE dive bombers	2, 280	.....
	PE-8	4E bombers	216	.....
Kazan'	PO-2	SE trainers	3, 000	.....
Kuybyshev (Twin plants side by side at same site)	IL-10	SE ground attack bombers.	2, 880 (4,800 capacity)	Capacity not reached after conversion from IL-2 ground attack bombers about January 1945.
Kuybyshev (Twin plants side by side at same site)	IL-10	SE ground attack bombers.	4, 800	.....
Saratov	YAK-3	SE fighters	3, 600	.....
Vol'sk	UT-2	SE trainers	240	.....
Central Industrial:				
Gor'kiy	LA-5	SE fighters	.....	.....
	LA-7	SE fighters	.....	.....
Kozlovka	A-7	gliders	480	.....
Moscow	TU-2	TE bombers	1, 020	Reported converted to TU-4 4E bombers.
Moscow	IL-2	SE ground attack bombers.	3, 120	Possibly converted to SU-5 or SU-6 ground attack bombers.
Moscow	LA-5	SE fighters	1, 560	.....
Moscow	YAK-3	SE fighters	780	.....
	YAK-7	SE fighter-trainers		
Moscow	YAK-1	SE fighters	.....	.....
	YAK-7	SE fighter-trainers	.....	.....
	LAGG-3	SE fighters	.....	.....
Shumerlya	SHCHE-2	TE transports	216 (360 capacity)	.....
				.....
Voronezh	.....		.....	Rebuilt in 1944. Possibly airframe plant.

* Dates of this information, with two or three exceptions, are from January to April 1945. Figures are not available in all cases, so indicated total is not comparable with total annual production figures given in text.

doubtedly are brought in from Ufa in the Urals, where the largest aircraft engine plant in the USSR, producing almost one-fourth of the total output, is located.

Aluminum is supplied almost completely from two plants east of the Urals, one at Kamensk-Uralski and one at Stalinsk. Three plants exist in European Russia, at Zaporozh'ye, Volkhov, and Kandalaksha. The first two were destroyed in the war after the Russians had moved much of their equipment to the eastern plants. The third had not gone into production at the beginning of the war, and because of its proximity to the Murmansk front it is believed that its equipment also was evacuated. The European USSR plants are just being put back into production, and their output for some time will remain small. For the present, therefore, aircraft aluminum supplies must be obtained from the plants east of the Urals.

(b) Production.—TABLES IX-59 and IX-60 list known airframe and engine plants, with last available information on production rates and types produced.

(c) Typical installation.—While available information of particular facilities is insufficient to describe a "typical plant," certain dominant characteristics are summarized below.

1. SIZE.—Soviet airframe and engine plants range in size between 1,500,000 and 2,500,000 square feet—larger than those of Germany; somewhat smaller than the Japanese facilities; and a good deal smaller than comparable United States plants. They occupy relatively well built-up sites and do not show the German tendency to disperse at a given location. Apparently engine plants are a good deal larger on the average than airframe facilities. Examples of plant sizes are shown in the tabulation on bomber, fighter, ground attack, and engine plants.

TABLE IX - 60

PRODUCTION AND LOCATION OF AIRCRAFT ENGINE PLANTS

Place	Last A/C engine types produced	Pre-VE Day * maximum annual output rate	Remarks
Volga:			
Kazan'	M-105R	8, 400	
Kuybyshev	M-42	16, 800	
Central Industrial:			
Gor'kiy	M-105	3, 600	This plant is part of Gor'kiy state auto plant No. 1.
Moscow	M-11	3, 600	
Moscow	M-38	4, 200	

* Dates of this information vary from January to April 1945. Figures do not necessarily represent production capacity.

TYPE OF PLANT	NO. OF PLANTS CONSIDERED	AVERAGE FLOOR SPACE PER PLANT (1,000 SQ. FT.)
Bomber	2	1,440
Fighter	1	1,430
Ground attack	2 *	1,820
Engine	2	2,415

* Two plants at the same site.

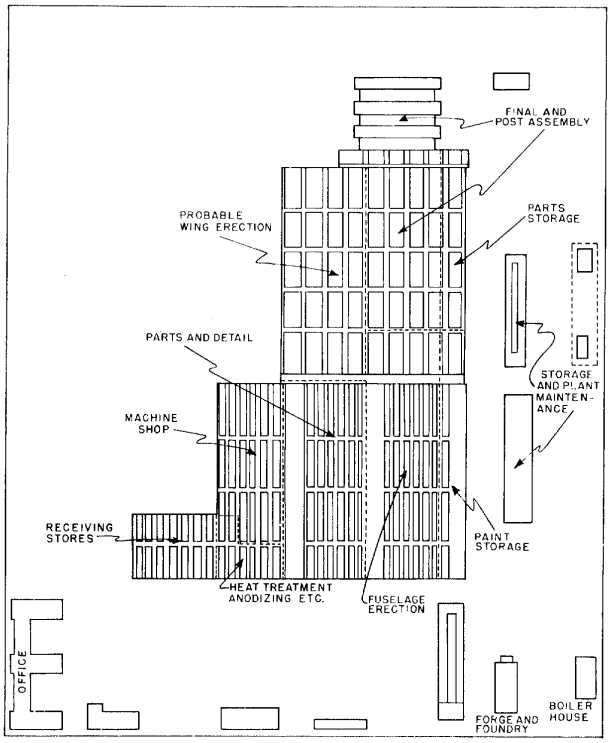


FIGURE IX-48. *Plan of airframe plant, Kazan', shows probable functional breakdown.*
Total plant area: 1,650,000 sq. ft. About 1945.

2. LAYOUT OF FACILITIES.—Figure IX-48 shows the layout of the airframe plant at Kazan' (Plant No. 22. This plant probably is "typical" insofar as size and probable flow of materials is concerned. Its one large building, however, makes it more built-up than most Soviet plants. The diagram has been annotated to show probable functions of different sections of the plant.

3. STRUCTURE.—Russian airframe plants are typically one-storied buildings, framed either of concrete or steel. Roof decks are generally of wood, but thin reinforced concrete slabs also are used. Roof trusses, which have spans varying from short to long, are steel, reinforced concrete or wood. The important buildings (machine shops, subassembly, etc.) are usually of multibay layout with usual heights to eaves varying between twenty and forty feet. Final assembly buildings are hangar type of long span.

Engine plants are also single story, multibay buildings of reinforced concrete or steel. Roof decks may be wood laid on wood, reinforced concrete or steel trusses, or are of reniforced concrete supported by concrete trusses. Height to eaves is rarely more than twenty-five feet.

4. PRODUCTION METHODS EMPLOYED.—No exact information is available on this subject but the following are pertinent generalizations: a comparison of size of Soviet airframe and engine plants, taking account of reported output and number of employees, with comparable United States plants indicates that United States plants are as much as one-third more efficient. (The differences in output in relation to floor area apparently does not result from differences in the number of shifts.) Soviet factories are probably slightly more efficient than were similar Japanese plants during the war, but utilize roughly the same production techniques, i.e., considerable hand work, relatively few or no single purpose machines, few automatic conveyor lines and belts.

5. LABOR FORCE.—A breakdown of employment in the aircraft industry by sex is not possible. At peak output (4,000-5,000 planes per month in 1944) the entire Soviet aircraft industry employed an estimated 1.2 to 1.5 million people. Roughly half of these probably were in airframe plants, 15% in engine and propeller plants, and the remaining 35% in "subcontracted and government furnished equipment" plants.

Since the end of the war the labor force has probably decreased in proportion to the decrease in output.

(d) Extent of war damage.—Detailed figures as to war damage and the extent to which it delayed the expansion of the Soviet aircraft industry are not available. The bombing of this industry was confined to relatively few plants (one of which had already been evacuated to the east) and the over-all effect was probably slight. The great movement of industry to the safer areas of the Ural-Volga region undoubtedly delayed expansion to a far greater degree; but even so, European USSR wound up the war producing 4,000 to 5,000 aircraft per month, a substantial achievement.

(e) Special problems.—Reported short-term shortages during the war, causing some reduction of output, may have resulted from transportation difficulties as well as shortages of certain raw materials. There were also shortages of machine tools and other equipment which probably delayed the production program. At the end of the war there were probably 150,000 to 200,000 machine tools in use in the USSR aircraft industry (there were about 275,000 so employed in the United States). Approximately 50,000 to 60,000 pieces, valued at over $300,000,000 came from United States lend-lease shipments.

(f) Conversion of the aircraft industry.—USSR aircraft production is now estimated at but a fraction of its wartime peak, and many facilities, comprising a large industrial potential, have been converted to turning out peacetime products. Machinery and tools of airframe plants, especially presses and hammers, can be used to fashion innumerable small metal products; and the vast floor area of airframe plants in which subassembly and assembly normally take place can be devoted to various fabricating processes. There also is no problem in converting engine plants to peacetime production, especially when the economy is under-tooled. Engine plants can be converted to the manufacture of auto and truck engines, pumps and compressors, etc. Conversion possibilities for propeller manufacturing plants also are substantial. Reconversion of the Soviet air industry apparently has been on the basis of entire plants, even though partial conversion of a larger number of plants would seem to be more desirable from a defense point of view.

(g) Underground facilities.—Little is known about the degree to which the USSR has put its aircraft industry underground. Experimentation with pilot plants is in progress, but there is no evidence of an extensive move in that direction. The Soviets have taken over some of the more important German underground establishments, and have acquired some knowledge of the technological problems involved. In view of the great demands on their own building industry to reconstruct the devastated areas, it is unlikely that much effort has been devoted to building underground installations.

(8) Wood products and paper

(a) General location.—The wood products industries (excluding pulp) are widely dispersed through European

FIGURE IX-49. *Lumbering operations, Karelo-Finnish SSR.* Prior to 1944.

USSR. Prewar production of lumber was centered in the Northwest (FIGURE IX-49) Central, and South regions. The latter, however, as well as White Russia, have had to rely on imports from the other two areas to an increasing extent because of timber deficiencies. The Volga region, likewise, was important, using both local timber and that floated down the Volga from the north. While current information on actual or planned production by regions is insufficient to determine the present picture, production of lumber is probably shifting toward a greater concentration in the north, where resources are larger, thereby reducing transportation costs. The pulp and paper industries are highly concentrated close to raw material sources in the Northwest Region and in the northern oblasts of the Central Industrial Region. A small development is found in the Volga region.

(b) Production.—Information on production of lumber, pulp, and paper is so incomplete as to make it difficult to gage the output for either the Soviet Union as a whole or for the area embraced in the European part. The estimates in the lumber tabulation, therefore, are rough calculations based on limited data available.

	SAWN LUMBER *Cubic meters*	PAPER *Tons*
USSR:		
1946 est.	14,000,000	540,000
1947 Plan (approx.)	18,000,000	690,000
1950 Plan	39,000,000	1,340,000
European USSR:		
1946 est.	11,000,000	460,000
1947 Plan (approx.)	14,000,000	580,000
1950 Plan (est.)	27,000,000	1,150,000

While the 1950 goal for lumber is only slightly in excess of prewar production, the corresponding target for paper is considerably in excess of the previous reported peak of 800 to 900 thousand odd tons. Official concern has been voiced in the Soviet press on numerous occasions over the unfavorable results of lumber production, since the poor showing of the industry has been delaying the construction program.

(c) Plants and products.—The number of plants and manufacturing centers which have been located within each region and oblast, together with the special products turned out is listed in TABLE IX-61. Reference to this table should be made with circumspection since some areas are reported on more completely than others. The size of the establishments in the Northwest and Central Regions, moreover, is believed to exceed those in other areas. Therefore, the importance of wood products in the Northwest and Central Regions appears understated while the Volga and Western Regions appear overly developed.

TABLE IX - 61

PRODUCTION AND LOCATION OF WOOD PROCESSING PLANTS

Region	Wood products	Cellulose and pulp	Paper	Special products
Northwest:				
Karelo-Finnish SSR.	2	2	4	Lumber, cellulose, wood pulp newsprint, cordwood, paper bags
Arkhangel'skaya O.	3	9	7	Lumber, cellulose, sulphate and sulphite pulp, newsprint, wrapping paper
Komi ASSR.....	..	1	..	Cellulose
Leningradskaya O.	..	10	9	Cellulose, mechanical wood pulp and sulphite pulp, paper and cardboard
Murmanskaya O..	1	..	..	Various wood products
Novgorodskaya O.	1	..	..	Plywood
Vologodskaya O..	20	4	4	Lumber, boxes, excelsior, mechanical and sulfite wood pulp, paper and cardboard
West:				
Estonian SSR....	8	..	..	Lumber, plywood, boxes, barrel boards, trunks, cases, spindles, excelsior
Latvian SSR.....	19	..	..	Lumber, veneer, plywood (for aircraft), boxes, telephone poles, ties, barrels, mine timber
Lithuanian SSR..	14	..	..	Lumber, plywood
Brestskaya O.....	1	..	..	Lumber
Gomel'skaya O...	3	..	..	Lumber, excelsior, cooperage products
Grodnenskaya O..	2	..	..	Lumber, plywood
Kaliningradskaya O.	..	1	1	Cellulose, paper
Minskaya O.....	4	..	..	Lumber, boxes, excelsior, shoe lasts, wooden pegs, furniture
Mogilëvskaya O..	5	..	..	Lumber, boxes, excelsior, office and bentwood furniture
Pinskaya O.....	3	..	..	Lumber, plywood furniture
Polesskaya O.....	6	..	..	Lumber, plywood, boxes, stoves
Vitebskaya O.....	9	..	..	Lumber, furniture carpenter's tools
South:				
Chernigovskaya O.	4	..	..	Lumber
Krymskaya O....	1	..	..	Barrels
Kamenets-Podol'skaya O.	4	..	..	Lumber, furniture
Khar'kovskaya O.	4	..	..	Lumber, excelsior, furniture
Kiyevskaya O....	12	..	..	Lumber, plywood, furniture
Kirovgradskaya O.	3	..	..	Lumber
L'vovskaya O....	2	..	..	Plywood, bentwood furniture
Nikolayevskaya O.	1	..	..	Lumber
Odesskaya O.....	2	..	..	Lumber, parquetry
Poltavskaya O...	4	..	..	Lumber
Stanislavskaya O.	2	..	..	Lumber, furniture
Sumskaya O.....	2	..	..	Lumber, window frames, doors, gates, field wagons
Vinnitskaya O....	4	..	..	Lumber, barrels, furniture, looms
Voroshilovgradskaya O.	1	..	..	Lumber
Zhitomirskaya O..	5	..	..	Lumber, bentwood furniture
Southeast:				
Rostovskaya O...	3	..	..	Lumber
Volga:				
Astrakhanskaya O.	9	..	..	Lumber

TABLE IX - 61 (Continued)

Region	Wood products	Cellulose and pulp	Paper	Special products
Volga: (*continued*)				
Kuybyshevskaya O.	10	..	2	Lumber, paper
Saratovskaya O...	18	..	..	Lumber, boxes, barrels, furniture, ammunition chests
Stalingradskaya O.	21	..	..	Lumber, boxes, excelsior, prefabricated houses
Tatar ASSR.....	11	1	1	Lumber, plywood and veneer for aircraft, skis, cellulose, paper
Ul'yanovskaya O .	19	..	2	Lumber, paper
Central Industrial:				
Chuvash ASSR...	17	..	1	Lumber, skis, rifle stocks, gun butts, sleds, furniture, ammunition chests, paper
Gor'korskaya O...	20	3	4	Lumber, plywood, veneer for aircraft, mechanical and sulphite pulp, newsprint, cardboard, wrapping paper
Ivanovskaya O...	9	..	1	Lumber, window frames, doors, ammunition chests, paper, cardboard
Kalininskaya O...	..	1	1	Cellulose, pulp, paper
Kalugzhskaya O..	1	..	..	Lumber
Kirovskaya O....	14	..	5	Lumber, plywood, matches, boxes, ammunition chests, cooperage materials, paper
Kostromskaya O..	20	..	1	Lumber, plywood, paper
Mari ASSR.....	5	2	1	Lumber, material for R.R. cars, cellulose, insulating paper, bags, stationery
Mordovian ASSR.	10	..	1	Lumber, furniture, paper
Moskovskaya O ..	10	1	3	Lumber, plywood, skis, pulp, paper
Penzenskaya O...	22	..	..	Lumber
Ryazanskaya O...	7	..	..	Lumber, plywood for aircraft, propellers
Tambovskaya O..	3	..	..	Lumber
Vladimirskaya O..	21	..	1	Lumber, paper
Voronezhskaya O.	4	..	..	Lumber
Yaroslavskaya O..	19	..	2	Lumber, boxes, plywood, barrels

(d) Typical plant.—The size and activities of individual establishments vary enormously from the large combines, producing a wide range of products, to the small, individual sawmills, with a very limited output. Combines are particularly common in the paper and pulp industry, because of the advantages obtained. Individual pulp plants are obliged to expend additional quantities of fuel to air-dry the pulp before transportation, whereas those operating in a combine pipe the pulp directly to the paper plant. The industry commonly uses the mechanical, sulfate and sulfite processes in pulp manufacture. These combines are dependent on large quantities of electrical power (usually thermal) and water for their operation. Paper produced is largely of low grade types. The wood-chemical industry is closely associated with these plants.

(e) War damages and special problems.—According to published statements in the Soviet press, the lumber, pulp, and paper industries sustained the following losses as a result of the German invasion:

Industry	Production
260 lumber mills and woodworking plants (sawn lumber)	12,000,000 cubic meters
28 plywood factories (plywood)	380,000 cubic meters
14 match factories	4,000,000 cases
77 paper and pulp mills (paper)	300,000 tons

If the Soviet sawmill industry was operating at only one-half of capacity before the war, as has been claimed, then this industry was probably not as severely set back as the paper and pulp industry. Moreover, much of the damage occurred in areas where the sawmill capacity exceeded the local timber supply. Nevertheless it is quite apparent that the production of lumber is not progressing smoothly. The conditions which are hindering more rapid advance are: 1) poor geographical distribution of sawmills, through failure of the industry to adjust itself to changing conditions; 2) transportation bottlenecks have slowed up deliveries of timber and lumber; 3) timber cutting has, in some instances, failed to supply sufficient material; 4) no definite labor problem can be defined but lumber, pulp, and paper mills must also have suffered from prevailing labor shortages and inefficiencies; and, 5) recovery of the paper and pulp mills, especially, will be slowed up by problems of rebuilding, and of supplying equipment.

Inasmuch as the shortage of lumber has been one of the underlying reasons for the inadequate showing made in construction work, it may be taken for granted that greater effort will be made toward achieving the goal of the fourth Five-Year Plan.

(9) Building materials

(a) General location

1. Cement.—The chief areas of cement production in European USSR are Stalinskaya, Moskovskaya, and Saratovskaya Oblasti. The Gigant plant, reputedly the largest in the Soviet Union, is located at Voskresensk, 56 miles southeast of Moscow. Other large centers are situated at Amvrosiyevka (Stalinskaya Oblast'), Podol'sk (Moskovskaya Oblast'), and Vol'sk (Saratovskaya Oblast'). The Volga region normally has a surplus. The Central and Southern regions will be deficient at least until plans for rehabilitation are completed. The average distance for hauling cement was on the increase prior to the war, and will continue to be large because of the movement from the manufacturing centers to deficit areas.

2. Brick and tile.—Brick- and tile-making is the most widely developed branch of the building materials industry due to the extensive distribution of raw materials, the simplicity of manufacture, and their general use for construction. Nevertheless, because of the great demand in heavily populated, industrialized areas, 75% of production of the USSR was concentrated in the South, Central, and Northwest regions before the war. Although the European USSR production doubtless diminished as a result of the war it may be expected to regain substantially its former position because of rehabilitation demands. In general, it may be said that the major "construction brick" plants are located near the important industrial centers, while those producing "refractory brick" are closely identified with the iron and steel industry.

3. Glass.—The glass industry has been long established in the Central and Southern regions with the greatest concentration in Moskovskaya, Vladimirskaya, Stalinskaya and Leningradskaya Oblasti. There are a number of centers in other oblasts, however, where glass production flourishes. The presence of large supplies of good quartz sand has been the main determining factor for location, but elsewhere the industrial demands for glass, together with a ready supply of fuel, has been responsible for the development of lesser resources.

(b) Production.—From the information released on production of building materials only an approximation can be made of current production figures. These are listed in the cement, brick, and glass tabulation, together

with goals under the current Five-Year Plan for the Soviet Union, and the probable share of European USSR.

	Cement *Tons*	Brick *Billions*	Window Glass *Sq. meters*
USSR:			
1946 (est.)	3,500,000	3	31,000,000
1947 Plan (est.)	5,900,000	5	44,000,000
1950 Plan (est.)	10,500,000	10 (est.)	80,000,000
European USSR:			
1946 (est.)	1,900,000	1.5	25,000,000
1947 Plan (est.)	3,200,000	2.7	37,000,000
1950 Plan (est.)	6,300,000	6.5	72,000,000

Prior to the war, about 60% of the cement output of the USSR was produced in the European zone. This percentage undoubtedly has since diminished because of plant destruction and the building of new factories elsewhere. It is expected, however, that during the course of the current plan the European USSR contribution will again reach 60% of production. Before the war European USSR produced approximately 70% of the brick, 45% of the tile, 70% of the lime, and 90% of the glass output of the entire Soviet Union. The proportionate shares of each material were somewhat less in 1946, but by 1950 they should be close to prewar percentages.

(c) Plants and products.—Table IX-62 is a compilation of important plants producing cement, brick, tile, and glass, arranged according to region and oblast. The information on cement plants probably covers a high percentage of the total cement industry, but there are serious deficiencies in the completeness of cover for the other types of building materials. Brick, tile, and glass establishments which render an important contribution to their respective industries are, doubtless, much more numerous than is indicated. Likewise, the coverage for lime, asbestos, and other special products of the building industry is very limited.

TABLE IX - 62

BUILDING MATERIAL PLANTS AND PRODUCTS, BY OBLAST

Region	Cement	Brick tile	Glass	Other	Special products
Northwest:					
Karelo-Finnish SSR.	..	2	1	1	Brick, glass, lime
Arkhangel'skaya O.	1	..	..	2	Cement, lime
Leningradskaya O.	6	2	6	3	Portland cement, concrete products, asbestos insulating material, brick, glass and porcelain products, lime
Murmanskaya O.	1	1	..	..	Cement, brick
Novgorodskaya O.	..	..	3	1	Glass and porcelain products, lime
Vologodskaya O.	1	..	1	..	Cement, glass
West:					
Estonian SSR.	3	15	1	1	Cement, plaster of paris, glass, red brick and silicate brick
Latvian SSR.	3	12	1	..	Cement, window glass, brick, tile, sewer pipe
Lithuanian SSR.	1	5	3	..	Brick, concrete and terrazzo products, glass
Baranovichskaya O.	..	2	..	..	Brick and tile
Gomel'skaya O.	..	5	1	..	Brick, glass
Grodenskaya O.	..	1	..	..	Brick, tile
Minskaya O.	..	12	2	..	Brick, glass
Mogilëvskaya O.	3	6	..	..	Brick, cement
Polesskaya O.	..	1	..	..	Brick
Vitebskaya O.	..	12	..	1	Brick, lime

TABLE IX - 62 (Continued)

Region	Cement	Brick tile	Glass	Other	Special products
South:					
Chernigovskaya O.	..	5	..	1	Brick, lime
Krymskaya O.	1	..	1	..	Cement, glass
Dnepropetrovskaya O.	2	7	..	..	Cement, brick
Kamenets-Podol'skaya O.	..	4	1	1	Brick, glass, lime
Khar'kovskaya O.	3	13	1	1	Cement, red brick and silicate brick, bottles, window glass, pyrex, lime
Kiyevskaya O.	1	17	1	..	Cement, brick, glass
Kirovgradskaya O.	..	4	..	..	Brick
Nikolayevskaya O.	..	..	1	..	Glass
Odesskaya O.	..	3	1	1	Brick, glass, lime
Poltavskaya O.	..	7	..	1	Brick, tile, lime
Rovenskaya O.	1	..	..	..	Cement
Stalinskaya O.	10	15	7	4	Portland and slag cement, glass, including shatterproof glass, porcelain, brick, and tile, lime, insulators
Stanislavskaya O.	..	1	..	..	Tile
Sumskaya O.	..	9	..	..	Brick
Vinnitskaya O.	..	11	..	..	Brick
Voroshilovgradskaya O.	..	2	..	2	Brick, lime
Zaporozhskaya O.	..	1	..	..	Brick
Zhitomirskaya O.	..	2	1	..	Brick, glass
Moldavian SSR.	..	6	..	1	Brick, tile, sewer pipe, lime
Southeast:					
Rostovskaya O.	1	7	..	4	Cement, brick, lime
Volga:					
Astrakhanskaya O.	..	6	..	..	Brick
Kuybyshevskaya O.	5	3	1	..	Cement, red brick, silicate brick, glass
Saratovskaya O.	7	7	..	1	Portland cement, special cement for gas and oil installations, red brick, silicate brick, lime
Stalingradskaya O.	..	6	1	..	Red brick, silicate brick, glass
Tatar ASSR.	1	2	..	1	Concrete products, brick, lime
Ul'yanovskaya O.	1	..	..	..	Cement
Central Industrial:					
Bryanskaya O.	2	..	1	..	Cement, glassware
Chuvash ASSR.	..	6	..	..	Brick
Gor'kovskaya O.	1	7	4	1	Cement, red brick, silicate brick, safety glass, optical glass, lime
Ivanovskaya O.	1	6	3	..	Slag cement, brick, glass and porcelain
Kalininskaya O.	2	3	3	1	Cement, red brick, silicate brick, tile, glass bulbs, and tubes, lime
Kaluzhskaya O.	..	..	..	1	Lime
Kirovskaya O.	..	1	2	..	Brick, window and lamp glass, glassware
Kostromskaya O.	1	1	..	..	Brick, cement
Kurskaya O.	..	2	..	..	Brick
Mari ASSR.	..	3	..	..	Red brick, silicate brick
Moskovskaya O.	10	3	9	2	Cement, ferro-concrete products, roofing materials, lime, red brick, refractory brick, slag brick, shatterproof glass, glass tubes, porcelain insulators, lime

TABLE IX - 62 (Continued)

Region	Cement	Brick tile	Glass	Other	Special products
Central Industrial: (Continued)					
Orlovskaya O. . . .	..	..	1	2	Glass, lime
Penzenskaya O. . .	1	6	1	..	Cement, brick, glass
Ryazanskaya O. .	3	1	1	1	Cement, brick, glass bulbs, tubes and receptacles, lime
Smolenskaya O. . .	..	..	2	..	Glass
Tambovskaya O. .	..	6	1	..	Brick, glass
Tul'skaya O.	2	..	..	..	Cement, slag cement
Vladimirskaya O .	..	5	7	..	Brick, safety glass, optical instruments, window glass, glass fabric
Voronezhskaya O.	2	7	..	2	Portland and slag cement, brick, lime
Yaroslavskaya O .	..	3	1	1	Brick, asbestos, insulating materials, porcelain

(d) Typical installation.—Soviet cement plants are, in the main, modern structures with considerable mechanized equipment. A number have been built according to American plans. In 134, 91% of the output was portland cement, with this product gaining increasing favor. The wet-process of manufacture, it has been announced, is to be adopted by the majority of cement mills. This method requires a smaller amount of fuel than the dry-process. Efficiency and quality of products are below United States standards. Brick-making plants include a wide range of establishments. Some are very large, well-equipped, and produce a good quality of brick. However, there are a great many small establishments producing sun-dried and other low quality bricks. During the past year plans were announced for production of mobile brick plants, with an individual capacity for one season of one million bricks and tiles. This type of plant consists primarily of a brick press and gas generator; wood is used for fuel. Operation of the unit requires 28 workers.

(e) War damage and special problems.—During the war, destruction to factories producing building materials, as reported in the Soviet press, amounted to 409 enterprises. These were said to include important cement plants at Yenakiyevo, Krichev, and Bryansk. Break-downs by type of material are not available. The industry as a whole was severely crippled during the war, resulting in the strictest economy of materials. While the production results announced for 1946 show large gains over 1945, the supply is still far behind the demands put upon it by the construction program, which in turn is retarding the development of the whole economy. The particular problems to be resolved include the following: 1) The enormous task of rehabilitation must be completed. Although large numbers of factories in the devastated area are said to have been reopened these are only in partial operation. 2) Much new equipment and spare parts are required, especially for the cement plants. 3) Local fuel and power shortages are hampering operations. 4) Shortage of labor has lowered the production of brick manufactories. 5) Brick production is also adversely affected by its seasonal nature, since the cold weather interrupts operation. Plans embody the installation of facilities which will enable year-round production, but rapid progress in this direction cannot be expected. 6) Improved distribution of enterprises must be carried out in order to decrease transportation requirements.

(10) Consumer goods

(a) General.—The production of consumer goods has a low priority in the economic planning of the Soviet Union. Since the inauguration of the Five-Year Plans, in 1928, consumer goods have received a minor share of Soviet industrial investments. Current allocation of investment capital constitutes about 20% of the total investment in industry. The supply of consumer goods, which prior to the war was already far from adequate, has since dropped to such a low level as to disturb the execution of other plans through lowered morale.

One of the stated objectives of the fourth Five-Year Plan is "to promote the production of consumer goods" and "secure an abundance of the principal items of consumer goods in the country." To this end reconversion of war plants, restoration of factories in devastated areas, and construction of new enterprises have been placed in the agenda for the 1946-50 period. Despite this professed concern for the welfare of the people, the goals for consumer goods items are far less ambitious than those for heavy industry and, generally speaking, are lower than those stated in the third Five-Year Plan.

Toward the end of 1946 it became apparent that the achievements of the consumer goods industry were not satisfactory. First, in November 1946, a decree was issued providing for accelerated production and distribution of consumer goods items by cooperatives. Then, in December, it was announced that goals for 1947 would be revised upward with emphasis on textiles, clothing, and shoes. According to 1946 results, as released by the State Planning Commission, the total production of consumer goods increased by 20% over 1945, but since 1945 was a very poor year, this increase did not represent much improvement. Such information as has been reported for the first quarter of 1947 does not indicate any appreciable improvement in the situation.

The alteration of the previously determined program for consumer goods must be attributed to concern over lessened morale and its contributory effects on other industry, rather than to any change in Soviet policy. Future production of consumer goods in all likelihood will be based on what the general morale will bear, with slight shifts in emphasis from time to time. While this policy may result in a temporary deviation from the immediate plans there probably will be no substantial slowing up of over-all plans for heavy industry.

The two following sections deal with representative branches of consumer goods industries.

(b) Textile industry

1. Location.—Linen production has been, and still is, largely concentrated in the flax-growing region of Northwest and North Central European USSR, especially the three oblasts of Yaroslavskaya, Ivanovskaya, and Vladimirskaya. In 1941 about 75% of the total USSR output came from these oblasts. The present trend appears to be an expansion of the manufacturing regions to the west and east of the three oblasts mentioned. Particularly in the west, an effort is being made to utilize for domestic purposes a high grade of flax, which formerly went mainly to the export trade.

The production of cotton textiles has long been centered in Moskovskaya and Ivanovskaya Oblasti and the city of Leningrad. The mills of these cities were formerly dependent on imports for a large portion of their raw materials. Through intensive cultivation of cotton in Central Asia and Transcaucasia, as well as a few other scattered areas, the USSR is now able to provide for her entire re-

quirements. Although the industry has become somewhat more diffused by constructing mills in the growing areas, considerable concentration in the old area remains. Moskovskaya Oblast' still manufactures about 40% of the total USSR production. Much of the cotton manufactured in European USSR is initially processed in the regions of cotton cultivation. Production of cotton textiles is insufficient for the needs of the population, even in European USSR where the industry is best developed. Attempts are being made to alleviate this condition by further expansion of domestic production, as well as through imports from satellite countries, using Soviet raw materials.

The principal centers for production of wool fabrics are Moskovskaya and Leningradskaya Oblasti. The city of Leningrad has long been known as a producer of fine cloth. Raw material, which was formerly imported to the extent of 40%, is now entirely obtained from domestic sources. These are, chiefly, South European Russia, Central Asia, and Transcaucasia. Raw materials, however, are not altogether satisfactory and still present a problem to the industry because of insufficient quantity and inferior quality. Several new mills have been constructed in Central Asia and Transcaucasia, but the concentration within European Russia is not materially changed. Wool cloth production is deficient, necessitating the acquisition of additional supplies through industrial expansion and importation.

The silk textile industry was formerly highly concentrated in Moskovskaya Oblast', utilizing mainly imported raw silk. The chief developments in the industry have been: 1) the elimination of imported raw silk in favor of the native product of Central Asia and Transcaucasia, and 2) the construction of many new plants in the latter area. As a result, European USSR's share of production is now probably between 65% and 75%, of which the major portion is in Moscow oblast. Artificial silk, or rayon, manufacture is likewise centered in the Moscow area and other oblasts adjoining to the west.

2. PRODUCTION.—The production of principal items of the textile industry of the USSR in 1946, together with the planned production for 1950, is listed in TABLE IX-63. Corresponding figures for European USSR, which are also included, constitute but a rough estimate, since information bearing on the situation is very fragmentary.

TABLE IX-63

ESTIMATED TEXTILE PRODUCTION, USSR

(Millions of meters)

Textiles	European USSR			USSR		
	1946	1947 Plan	1950 Plan	1946	1947 Plan	1950 Plan
Cotton	1,700	2,400	4,300	1,890	2,680	4,686
Wool	62	81	140	74	96	159
Linen	57	77	175	67	91	190
Silk (natural and artificial)	38	48	105	58	74	141

3. PLANTS AND PRODUCTS.—TABLE IX-64 incorporates the main known factories together with important producing centers, according to region and oblast. While this table does not give a full picture of the producing areas in European USSR, it serves to point out the large number of producing units and establishes definite concentrations of the industry. The large number of units tabulated for the Central Industrial Region gives a somewhat unbalanced picture due to less complete coverage in other areas but generally reflects the great concentration (about 80%) of the industry in that region. Many small manufacturing centers, especially in the flax processing and clothing branches, have not been included, because of their relatively low production.

TABLE IX-64

TEXTILE PLANTS AND PRODUCTS, BY OBLAST, EUROPEAN USSR

Region	Cotton	Wool	Linen	Silk	Clothing	Other	Special products
Northwest:							
Arkhangel'skaya O.	..	..	..	..	1	..	Knitted goods
Komi ASSR	..	..	..	1	..	..	Silk fabric
Leningradskaya O.	2	1	..	1	..	..	Cotton, wool, and rayon cloth, cotton thread, and yarn; flax fiber
Murmanskaya O.	..	..	..	..	..	2	Jute fiber. Knitted goods and flax fiber is produced in many small towns
Pskovskaya O.	..	..	1	..	..	1	Flax fiber and linen cloth; in addition, small quantities of flax fiber are produced in numerous small localities
West:							
Estonian SSR	2	..	..	..	2	..	Cotton cloth, clothing, tricotage
Latvian SSR	1	..	..	..	..	..	Cotton textiles
Lithuanian SSR	1	2	..	..	..	..	Cotton and woolen textiles; textile products are produced in other small enterprises
Grodnenskaya O.	..	1	..	..	..	..	Woolen textile factory under construction, 1946
Minskaya O.	..	1	..	..	..	..	Woolen textile factory under construction, 1946
Mogilëvskaya O.	..	..	..	1	..	..	Rayon cloth
Vitebskaya O.	..	1	1	..	1	..	Woolen textiles; knitted goods; woolen factory under construction
South:							
Krymskaya O.	..	..	..	..	2	..	Knitted goods
Khar'kovskaya O.	1	..	..	..	..	..	Cotton textiles
Kiyevskaya O.	..	1	1	1	..	..	Woolen, linen, and rayon textiles
L'vovskaya O.	1	..	..	..	..	..	Cotton textiles
Poltavskaya O.	..	1	..	..	..	..	Woolen textile factory under construction, 1946
Voroshilovgradskaya O.	..	1	..	..	..	..	Woolen textile factory under construction, 1946
Southeast:							
Rostovskaya O.	..	..	..	..	2	..	Knitted goods
Volga:							
Kuybyshevskaya O.	..	..	..	..	..	..	Knitted goods factory planned
Saratovskaya O.	..	..	..	..	..	1	Parachutes
Stalingradskaya O.	..	..	..	..	1	..	Knitted goods
Central Industrial:							
Bryanskaya O.	..	3	..	..	..	..	Broadcloth
Chuvash ASSR	..	..	..	..	..	1	Fiber insulating material

TABLE IX - 64 (Continued)

Region	Cotton	Wool	Linen	Silk	Clothing	Other	Special products
Central Industrial: *(continued)*							
Gor'kovskaya O.	..	..	..	..	..	2	Marine rope, flax fiber
Ivanovskaya O..	36	..	22	2	6	1	Cotton, woolen and linen textiles; rayon, parachute silk, clothing, canvas
Kalininskaya O .	1	..	2	1	..	..	Cotton, linen, and silk textiles
Kaluzhskaya O..	..	..	..	..	1	..	Clothing
Kostromskaya O.	..	..	2	..	3	1	Linen textiles, clothing, cartridge belts.
Kurskaya O.....	..	..	..	..	1	..	Knitted goods
Mordovian ASSR	1	..	..	..	..	..	Textile products for armament combine
Moskovskaya O.	66	24	2	18	36	14	Cotton, woolen, linen, silk cloth, civilian and military clothing, parachutes, parachute cordage, balloons, fire hose, belting, covering for aircraft wings and life belts
Orlovskaya O...	..	..	..	..	1	..	Knitted goods; spinning mill planned
Penzenskaya O..	..	..	..	..	..	..	Knitted goods factory reported converted to anti-tank-shell factory
Ryazanskaya O..	2	2	2	..	3	1	Textiles, clothing, rope and other hemp and jute products
Smolenskaya O..	..	..	..	..	..	1	Flax fiber; other small clothing centers, stocking factory planned
Tul'skaya O....	..	..	..	..	1	1	Clothing, parachutes, stocking factory planned; a number of small clothing centers.
Vladimirskaya O.	9	..	2	..	1	..	Cotton, linen textiles, clothing, stocking factory planned
Yaroslavskaya O.	4	2	6	..	1	3	Cotton, woolen, and linen textiles, civilian and special types of military clothing, hose, "Zelloid" fabric for cartridge bags.

4. TYPICAL INSTALLATION.—Soviet textile plants range in size from small local industry establishments and industrial cooperatives, with hand operation or a small degree of mechanization, to large, modern factories equipped with the latest types of automatic machines. It is estimated that the output of local industry amounts to 20% to 25% of the entire textile industry. In 1939 about 75% of the spindle capacity was of the modern, ring type, spindle. By 1940 manually operated machines in cotton spinning were largely eliminated through the adoption of mechanized equipment. Prior to the war about 90% of the total amount of fabric produced in USSR was cotton goods; the proportion remains the same today.

5. WAR DAMAGE.—According to Soviet statements the textile industry suffered the following losses:

120 cotton mills
75 knit goods mills
69 linen mills
125 hemp and jute mills
36 worsted goods mills
8 artificial fiber factories

Destruction of these plants involved a decrease of:

	PERCENT OF TOTAL USSR
1,900,000 spindles	18.7
35,000 looms	13.8
14,000 knitting machines	33.4

This destruction probably included the whole artificial-silk (rayon) industry but natural-silk-mill losses were relatively small. Soviet claims concerning loss of machinery run from 5% to 10% higher than those listed above.

Official sources state that many textile factories in White Russian SSR, Ukrainian SSR, Estonian SSR, and Leningradskaya Oblast' were wholly or partly evacuated to the Urals, Central Asia, and Siberia in 1941. A few of the newer plants near the front were converted to essential war industries. By 1942 rehabilitation had begun, and some of the plants evacuated were gradually returned to their former locations. The industry is at present faced with the herculean task of rebuilding its factories, reconverting others from wartime production to peacetime goods, requisitioning adequate textile machinery, and training new workers. Raw materials are judged to be fairly adequate at present in view of curtailed requirements, but cotton production will have to be greatly increased to meet the demands of the expanding industry. During the war, cloth production was given over largely to supplying military needs for uniforms, blankets, parachutes, balloons, canvas material, tents, and cartridge bags; a number of plants were transformed to armament factories.

(c) Leather and shoes

1. LOCATION.—The leather industry, including the manufacture of leather shoes, is most strongly established in Moskovskaya, Leningradskaya, Kiyevskaya, and Gor'kovskaya Oblasti. Regionally, the Central and Southern areas are the most important, while the leading manufacturing centers are found in the cities of Moscow, Leningrad, Kiev, and Rostov-na-Donu. The producing areas draw mainly on raw materials obtained locally, although most of the heavier hides, such as are used for sole leather, are shipped from Transcaucasia and Central Asia. While the trend, as reflected in Soviet plans, is to increase the proportion of production outside European USSR there is not expected to be any substantial change within the current plan period. Substitute footwear of felt and birch bast (woven birch fiber) is widely produced and used. The deficiency of leather footwear in rural areas is forcibly compensated by the extensive use of birch sandals in wintertime, while in summer the peasants customarily go barefoot.

2. PRODUCTION.—The production of leather shoes in the Soviet Union in 1946 is estimated to have been approximately 80 million pairs. This was supplemented by some 30 to 40 million pairs of rubber footwear and unknown quantities of felt boots and birch sandals. The annual output of leather shoes in the Soviet Union is slightly under one-half pair per person as compared with 3 pairs in the United States. The tabulation on shoe output shows the relative

production of leather shoes in European USSR as compared with the entire country.

	European USSR	USSR
	Millions of pairs	
1946 est.	70	80
1947 plan (approx.)	100	115
1950 plan	210 (est.)	240

The plan for 1950 approximates the prewar production but must supply an increased population. In the doubtful event of fulfillment, the Soviet population will still be poorly shod.

Figures on leather production are insufficient to make a similar comparison. Current production is far below the prewar output, which also was inadequate. European USSR produces, predominantly, light types of leather.

3. Plants and products.—Table IX-65 lists, by economic region and oblast, the principal leather and shoe factories in European USSR. As the data incorporated are based very largely on prewar information the list cannot be said to be complete. Probably none of the plants in occupied areas has at this date (March 1947), resumed more than partial operation, while others doubtless have not yet reopened. The Soviet press claims that over 90% of the prewar shoe factories in the Ukraine were operating to some degree in late 1946. Not included in this list are the numerous industrial cooperatives, which together account for nearly one-third the Soviet shoe production nor, so far as is known, factories devoted exclusively to the manufacture of birch bast sandals or felt boots.

TABLE IX - 65

SHOE AND LEATHER PLANTS AND PRODUCTS, BY OBLAST, EUROPEAN USSR

Region	Leather factories	Shoe factories	Products
Northwest:			
Leningradskaya O.	9	4	All but one of the factories are located in the city of Leningrad. In addition there are two factories producing rubber footwear. Products include leather, artificial leather, and a wide variety
Arkhangel'skaya O.	1	..	Leather
Komi ASSR.	1	..	Leather
Novgorodskaya O.	..	1	Shoes and leather products
Pskovskaya O.	2	..	Leather
Vologodskaya O.	1	1	Leather and shoes
West:			
Estonian SSR.	?	3	Leather and shoes; total annual production of shoes is under 500,000 pairs
Latvian SSR.	?	?	Leather and shoes; total annual production of shoes is under 500,000 pairs
Lithuanain SSR.	?	?	Leather and shoes; total annual production of shoes is probably no more than 250,000 pairs
Baranovichskaya O.	..	1	Planned production of shoes in 1950, 900,000 pairs
Grodenskaya O.	..	1	Shoes
Minskaya O.	1	2	Leather and shoes
Mogilëvskaya O.	2	..	Leather
Vitebskaya O.	1	2	Leather and shoes
South:			
Krymskaya O.	1	1	Leather and shoes
Dnepropetrovskaya O.	1	1	Leather and shoes
Khar'kovskaya O.	3	2	Leather and shoes
Khersonskaya O.	..	1	Shoes
Kiyevskaya O.	6	5	Leather and shoes
L'vovskaya O.	..	1	Shoes
Nikolayevskaya O.	..	1	Shoes
Odesskaya O.	5	1	Leather and shoes
Poltavskaya O.	5	1	Leather and shoes
Stalinskaya O.	1	2	Leather and shoes
Sumskaya O.	1	1	Leather and shoes
Vinnitskaya O.	..	2	Shoes
Voroshilovgradskaya O.	1	..	Artificial leather
Zaprozhskaya O.	..	2	Shoes
Zhitomirskaya O.	1	2	Leather and shoes
Southeast:			
Rostovskaya O.	5	3	Leather and shoes. One of largest shoe factories in USSR is located in Rostov-na-Donu
Volga:			
Astrakhanskaya O.	1	1	Leather and shoes
Kuybyshevskaya O.	4	1	Leather and shoes
Saratovskaya O.	5	1	Leather and shoes
Stalingradskaya O.	1	1	Leather and shoes
Tatar ASSR.	3	1	Leather, artificial leather, and shoes
Ul'yanovskaya O.	1	..	Leather
Central Industrial:			
Bryanskaya O.	1	1	Leather and shoes
Chuvash ASSR.	2	..	Leather
Gor'kovskaya O.	11	1	Leather, artificial leather, and shoes
Ivanovskaya O.	3	1	Leather, artificial leather, and shoes
Kalininskaya O.	6	2	Leather and shoes
Kaluzhskaya O.	1	..	Leather
Kirovskaya O.	6	..	Leather and artificial leather
Kostromskaya O.	2	1	Shoes
Kurskaya O.	2	1	Leather and shoes
Moskovskaya O.	17	9	Leather and shoes. Includes 4 artificial leather plants; 12 leather and 7 shoe factories are located in Moscow city
Orlovskaya O.	3	1	Leather and shoes
Penzenskaya O.	1	..	Leather
Ryazanskaya O.	1	1	Leather and shoes
Smolenskaya O.	2	..	Leather
Tambovskaya O.	2	..	Leather and artificial leather
Tul'skaya O.	1	..	Leather
Vladimirskaya O.	2	..	Leather and artificial leather
Voronezhskaya O.	1	..	Leather
Yaroslavskaya O.	2	1	Leather and shoes

4. Typical installation.—As in the United States, there is a marked disparity in the scale of operations of the shoe industry. Plants range in size from the small cobbler shops of the collective farm, the intermediate establishments of the producers and disabled veterans' cooperatives,

to the large, modernly equipped factories. Foremost among the latter are the Skorokhod factory, with a planned production of 15,500,000 pairs of shoes in 1950, the Parizhskaya Kommuna factory in Moscow, and the Mikoyan plant in Rostov-na-Donu. Plant specialization does not appear to be carried to the same high degree attained in the United States, nor does the Soviet industry offer the great variety of types and styles that is supplied by American factories. The average worker is not well trained, so that poor workmanship, coupled with low quality raw materials, produces in general an inferior product which wears out rapidly.

5. WAR DAMAGES AND SPECIAL PROBLEMS.—The leather shoe industry of the USSR suffered severely from the German invasion, about 70% of the manufacturing capacity being lost in the initial stages of the war. The annual production, which has surpassed 200 million pairs prior to the war, had, by V-E Day, sunk to a very low level. Tanneries probably suffered somewhat less in the matter of destruction. Recovery for the whole industry, to date, has not been rapid.

In order to attain its goal of 240 million pairs of shoes in 1950, the leather and shoe industry must overcome some difficult problems. 1) There is the tremendous task of rehabilitating and expanding the plants themselves. 2) More adequate supplies of machinery and parts must be provided to replace old and worn out equipment, as well as to outfit the new factories. 3) A shortage of engineers and technicians exists. Moreover, old workers require reorientation to civilian production, while many additional workers will have to be trained. 4) The industry, which even in prewar days was plagued with a raw-material shortage, finds itself in a still worse predicament because of depletion of the cattle herds and shortages of other materials. In prewar days, leather substitutes (rubber, felt, wood fiber) constituted the major source of raw materials in the shoe industry. The leather industry is further handicapped by a deficiency of tanning. 5) Finally, the products of the industry are of inferior quality, as a result of the above deficiencies. Even before the war shoes could not be guaranteed for more than 30 days wear.

Some increment in current supply will accrue through importations from satellite areas but the amount is not expected to be sufficient to alter the situation appreciably. An unfavorable condition, therefore, is likely to persist during the current plan, unless the Soviet Government radically alters its policy toward the development of consumers' goods.

(11) Optical and precision instruments, and medical equipment

(a) General location.—The manufacture of optical and precision instruments and medical equipment is mainly in the cities of Leningrad and Moscow; Gor'kovskaya Oblast' is next in importance. In addition, there are plants scattered through other oblasts of the Central and Volga regions. During the war, factories were wholly or partially evacuated to the eastern part of the European area and to the Urals. It appears that the major portion of the industry so transferred has been returned to its previous location.

(b) Over-all production.—Figures on production for either the Soviet Union as a whole or for European USSR are not available. A very substantial part of the total output, however, is produced within European USSR. Construction of new factories has increased production elsewhere, notably in the Urals; but, in view of the return of much industry to its former site, the net result has been to decrease the European proportion only slightly. The Soviets visualize a stupendous development in these industries during the current plan in order to overcome their present deficiencies. For instance, the goal for optical and electric measuring instruments for 1950 is seven times the production in 1940. Indications that the industry has not been progressing according to schedule were borne out by recently published figures. Results for 1946, released by the State Planning Commission, show that the Machine and Apparatus Building Industry failed to meet its goal by a small margin. Unknown, but probably appreciable amounts of German and Austrian finished products, equipment, and trained workers have been put at Soviet industry's disposal in the Russian-controlled zones, as well as within the USSR itself. The high quality of these additions, as well as the relative increase in manufacturing facilities made available, should aid materially in expansion of optical, precision, and medical equipment production during the fourth Five-Year Plan.

(c) Plants and products.—TABLE IX-66 lists by economic region and oblast the number of plants and the products manufactured. Since little information is available concerning establishments manufacturing medical equipment, the plants incorporated in the table are few in number and do not represent the entire industry.

TABLE IX - 66

THE PRECISION EQUIPMENT INDUSTRY, BY PLANTS AND OBLAST, EUROPEAN USSR

Region	Optical instruments	Precision instruments	Medical equipment	Special products
Northwest:				
Leningradskaya O.	7	12	1	Navigation instruments, artillery range finders, telescopic sights, aiming circles, binoculars, telescopes, microscopes, periscopes, panoramic telescopes, blinker beacons, pressure gages, voltmeters, direction finding equipment, electrical mine detectors, electrical counters, AA data computers, meteorologic apparatus, automatic compasses for aircraft, manometers, bomb control mechanisms, shell gages, sliding gages
West:				
Gomel'skaya O.	..	..	1	Artificial limbs
Minskaya O.	..	..	1	Artificial limbs
Southeast:				
Rostovskaya O.	..	2	1	Precision instruments, artificial limbs
Volga:				
Kuybyshevskaya O.	1	1	..	Field glasses, compasses, periscopes, telescopic sights, gages, time fuses
Saratovskaya O.	1	..	1	AA range and direction finders
Tatar ASSR	2	..	..	Telescopes, periscope parts, range finders, protectoscopes for tanks, artificial limbs
Central Industrial:				
Gor'kovskaya O.	2	3	2	Optical glasses for submarines and firing equipment, panoramic sights, direction finding equipment, voltmeters, wheatstone bridges, radio compasses, electrical devices for submarines, surgical instruments

TABLE IX - 66 (Continued)

Region	Optical instruments	Precision equipment	Medical instruments	Special products
Central Industry: (Continued)				
Kirovskaya O. .	1	. .	. .	Field glasses, telescope sights, blind-flying instruments, speedometers
Kurskaya O. . . .	. .	1	. .	Geological measuring instruments
Mari ASSR. . . .	3	. .	. .	Stereotelescopes, binoculars, submarine range glasses, telescopic sights, lenses
Mordovian ASSR.	1	1	. .	Optical glass repair work, electrical measuring instruments
Moskovskaya O.	7	17	1	Range finders, periscopes, field glasses, telescopic sights, telescopes, optical lenses, signal light apparatus, sighting mechanisms, bomb release devices, eyeglasses, sound detectors, machine control apparatus for metal and textile industries, fuel gages, altimeters, automatic pilots, electric gages, steam and temperature regulators, marine range and speed gages, AAA control devices, surveying instruments, manometers, scales, micrometers, temperature gages, compasses, X-ray apparatus
Penzenskaya O.	2	. .	1	Optical glass, bomb sights, optical instruments for submarines, disinfecting apparatus for hospitals
Vladimirskaya O.	. .	2	. .	Optical instruments, odometers, speedmeters, fuel gages, altimeters, manometers, electric signal devices, automatic pilots
Yaroslavskaya O.	. .	2	. .	Electrical measuring instruments, precision machines

(d) Typical plant.—Based on the small amount of descriptive data available, the plants manufacturing optical, precision, and medical equipment may be divided into two groups: those which are devoted entirely to the manufacture of these products, and those which manufacture other related items as well. The optical-instrument factories tend to be more specialized than those producing precision instruments. The latter sometimes are adjuncts of munitions, aircraft, telecommunications, or electrical products manufacturing plants. Some of the factories involved employed from 5,000 to 10,000 people at the peak of production. The average size of a factory is not known. An American engineer who had the opportunity to observe the manufacture of control instruments described the Soviet industry as being deficient in facilities and skill. Some improvement in this situation may be expected from the infusion of German workers and equipment.

(e) War damage and special problems.—Details are lacking on the extent of damage suffered to these industries during the war. Installations located in invaded areas contributed a relatively minor part of the total production. Moreover, some installations in the important Leningrad and Moscow areas were evacuated to the Urals. There is reason to believe, therefore, that factories and equipment were not severely impaired. Since production facilities were expanded during the war, and additional foreign equipment has been brought into the country, the current position should be quite favorable compared with the prewar period. Nevertheless, there are still many problems. The manufacture of optical, precision, and medical equipment is in the early stages of development in the USSR, and must undergo a great expansion in order to support the over-all economic plans. Factories must be restored and expanded, and new plants must be built. Larger quantities of machinery will have to be supplied. Technique of manufacture must be improved and a larger body of skilled workers trained. It is impossible to assess the extent to which these difficulties will be solved by the introduction of German technique and equipment. However, it seems a reasonable assumption that both the quantity and quality of the products will be improved in the course of the current plan, and that these industries will attain a better position than ever before.

The optical, precision, and medical equipment industries have a high degree of concentration in the cities of Moscow and Leningrad. Despite some dispersal during the war, the trend since has been toward a regrouping of the plants in the old areas. According to German experience these high-priority war manufactures were found suitable to underground production. There is no evidence to date that the Soviets have actually moved, or contemplate moving, elements of these industries underground, but it is readily conceivable that some of the new establishments which may be constructed with German help may be so located.

(12) Electrical and communications equipment

(a) Location of industry (TABLE IX-67).—At the beginning of World War II, the main plants and research laboratories of the telecommunications and lighting equipment industry were located in the Moscow-Leningrad area. Of a total of approximately 128 plants in the entire Soviet Union, about 100 plants or 80% were in European USSR, and of this number over half were concentrated in the city of Leningrad and in Moskovskaya Oblast'. The main research laboratories were associated with the universities in Leningrad and Moscow, and with the National Academy of Sciences and the Electrical Institute in Moscow.

In the fall of 1941 many factories and all research institutes were evacuated to the Urals, West Siberia, and Central Asia. The Soviets have stated that all the radio factories of Leningrad and the majority of the plants of the entire radio industry were evacuated to the east. By 1944 some evacuated factories were being returned to the west. To what extent this movement has been continued cannot be ascertained. In a few specific instances, evacuated plants are known to be operating in their exact prewar locations, while in one case a plant has been returned to Moscow but to a new building. This same plant appears to have been moved in its entirety, leaving no duplicate plant in its wartime site. On the other hand, in one instance a factory has remained in its evacuated location, and a similar plant is operating in its former location, using equipment received as reparations. There are probably similar cases, in line with the present Soviet tendency toward dispersal of industry. Further expansion of the communications equipment industry is provided for in the fourth Five-Year Plan, which calls for the building of two plants for manufacturing of cable, two for radio receivers, one for ship radio receivers, one for television equipment, and one for cathode ray tubes. It is possible, however, that some or all of these plants will actually be restored war-damaged factories, rather than entirely new installations.

All research laboratories were evacuated in the fall of 1941. Return of their personnel and equipment began in

1944. It is probable that most of them have been returned to Moscow and Leningrad by this time, although some branch laboratories may have been retained in the evacuated locations. In 1946 it was reported that new scientific institutes had been opened, and that an All-Union Scientific Research Institute for Television Equipment is to be created under the new plan.

In addition to the equipment from German plants which has already been transported into the USSR proper, there are still many firms in the Soviet Zone of Germany producing various types of signal equipment for the USSR. The tendency has been to use these plants until available raw materials are used up, and then to remove equipment and personnel to the Soviet Union. The disposition of such personnel and equipment is not certain, but it is known that they have been sent to different parts of the country.

TABLE IX - 67

PRODUCTION AND LOCATION OF TELECOMMUNICATIONS EQUIPMENT INDUSTRY, EUROPEAN USSR

Region	Number of plants	Production
North and Northwest:		
Leningradskaya O...	13	Telephone and telegraph products: telegraph sets, ship telegraph sets, teletypewriters, telephone sets, field telephones, hydrophones, radiotelephones, telephone exchanges, automatic telephone exchanges, cable, railway signal equipment. Radio products: equipment for armed forces, receivers and transmitters, broadcasting stations, long and short wave and television broadcast equipment, assembly of television receivers, cabinets for television receivers, assembly of stations, including mobile and direction finding stations, loudspeakers, and tubes of various types, including television and ultrashort wave tubes. Also light bulbs, including milliwatt bulbs, electric mines and steering devices, batteries.
West:		
Estonian SSR.....	1	Six-tube radio receivers (1946 planned output—6,000) loudspeakers (1946 planned output—over 70,000).
Latvian SSR.....	3	Telephones, manual and automatic telephone, exchanges, telephone cables, radio receivers, components, electric cable, light bulbs, flashlights and batteries.
Lithuania and Lithuanian SSR.	5	Radio appliances.
Brestskaya O.....	1	Radar.
Minskaya O.....	1	Five-tube radio receivers (prewar output 52,000 sets per year, but by end of 1950 output expected to reach only 35,000 sets per year). Also radio parts.
South:		
Khar'kovskaya O....	2	Railway signal and radio equipment.
Kiyevskaya O.....	2	Radio receivers. (Output between 1944 and Sept. 1945 30,000 receivers); cable.
L'vovskaya O.....	..	Telephone and telegraph instruments, radio receivers.
Volga:		
Kuybyshevskaya O...	3	Electric equipment, electronic components, and possibly repair of radio receivers.
Saratovskaya O.....	6	Telegraph sets, teletypewriters, telegraph wire, direction finding equipment, and radio components.

TABLE IX - 67 (Continued)

Region	Number of plants	Production
Central Industrial:		
Chuvash ASSR.....	1	Telephone and radio parts.
Gor'kovskaya O.....	4	Telephone and radio installations for airfields, aircraft, tanks, submarines, and signal units; radio transmitters, compasses, direction finders, and components.
Ivanovskaya O.....	2	Submarine, telephone, telegraph, and noninsulated cable, electric cable and wire, including high tension wire; also electronic components.
Kalininskaya O.....	1	Unconfirmed. Radio tubes and light bulbs.
Moskovskaya O.....	27	Telephone and telegraph products: Plastic telephones, portable telephones, radiotelephones (including assembly on trucks), telephone cord, telegraph wire, various kinds of cable, including copper, aluminum, low strength, and rubber-insulated cable, and semifinished products for the cable industry. Radio products: installations of all types, including sets for aircraft and tanks, direction finders; plastic radio cabinets; tubes of various types; and other components. Also illuminating cable, fluorescent lamps, and light bulbs.
Tambovskaya O.....	1	Repairs of telephones, teletypewriters, and radio equipment.
Tul'skaya O.....	1	8 types of dynamic loudspeakers.
Vladimirskaya O.....	3	Civilian radio receivers (during the war produced nearly 3,000 receivers per month for armed forces); also components and electric signal assembly.
Voronezhskaya O....	1	Battery radio receivers and loudspeakers.
Yaroslavskaya O.....	1	Radio tubes.
Urals:		
Bashkir ASSR.....	1	Telephones.
Udmurt ASSR.....	1	Civilian radio receivers.

(b) Production figures.—Few actual statistics are available on the production of signal and lighting equipment in the USSR, but it is known that the industry's prewar capacity was insufficient for the needs of the country. Telephone and telegraph equipment was antiquated and inadequate. Radio equipment was more modern and more extensively used than wire (FIGURE IX-50), but the Soviet system of controlling broadcast information by use of communal loud speakers and wired receivers so limited the variety and amount of equipment produced that it prevented any great development of radio factories. Although the Soviet engineers made a practice of copying imported communications equipment and of utilizing foreign technical assistance in setting up modern construction methods, they were not able to overcome deficiencies in mass production. The main cause of this weakness was the inadequate number of production engineers and technicians capable of converting theory into practice.

The advent of World War II brought a realization of the need for expansion of the communications equipment industry. Lend-lease equipment from the United States and Great Britain, plus captured German equipment, overcame the wartime deficiency and provided the USSR with a modern military signal system. Although Soviet production in 1942 was below prewar, due to war damage and displacement, it has been increasing ever since. A definite comparison of prewar and present output is possible with

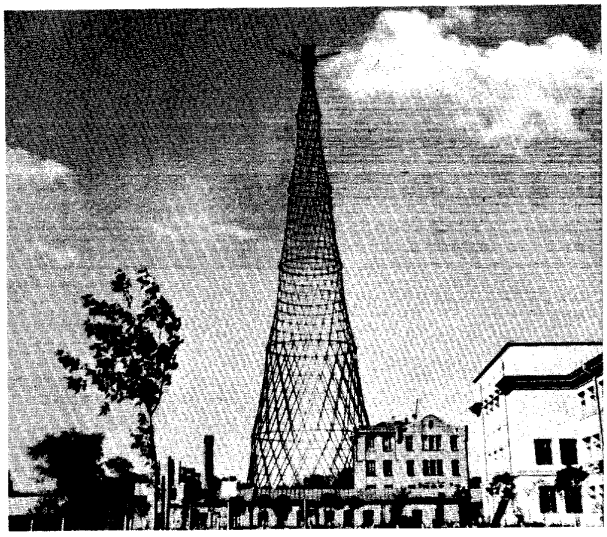


FIGURE IX-50. *Radio tower, Moscow. 1944.*

respect to radio receivers only. According to the Soviet press and radio, the 1945 production of receivers for the entire country was between 300,000 and 320,000, or about twice as many as in 1940. Before the war the majority of receiver plants were located in the European area and available information on the present distribution shows only slight change. Total planned output for 1946 was 354,000 receivers, and the Ministry of Communications Equipment Industry, which supervises radio production is reported to have fulfilled its 1946 plan by 103 percent. By the end of 1950, annual output is planned to reach 925,000. Increased production in 1946, as compared with prewar, has also been reported in regard to other types of signal equipment, and the new Five-Year Plan calls for additional expansion.

(c) Typical plant.—Because the Soviet communications and lighting equipment industry manufactures such a wide diversity of products, and because so many of its plants were evacuated during the war into unsuitable buildings, it is difficult to describe a typical plant. The radar factory described below is said by the Soviets to set the pattern for their future radio plants.

The factory was observed in the spring of 1944. The building, located in the suburbs of Moscow, is modern and compares favorably with United States factory buildings. It has 140,000 square feet of floor space on 4 floors of large, well-lighted rooms. Before being bombed and evacuated in 1941, it housed an aircraft accessories plant. In 1944 it was completely repaired and prepared for radar manufacturing. Although the preparations were made when the Germans were over 700 miles away, precautions against bombing and chemical warfare attacks were taken. The basement was strengthened with concrete to provide shelters; one section was devoted to a gas-proof shelter, including medical facilities, extra clothing, showers, etc. A central telephone control room was also located in the basement.

The factory was employing 1,500 people, and expected to reach 4,000 by August 1, 1944. It was producing an IFF (Identification Friend or Foe) airborne set at the rate of 150 per day; output was to reach 500 per day within 3 months. This unit required 45 hours to build, but the time was to be reduced to 35 hours upon completion of the assembly conveyor. The conveyor was well laid out and was the result of a study by a group experienced in quantity production; it was about 120 feet long and was to be operated by 104 women. The plant had also just started pre-production of ground and ship early warning (search) sets. The first 10 were being assembled, largely by hand, but a small dolly-type track was being installed for future assembly. The factory was also considering production of an airborne Aircraft Intercept set.

The plant incorporated the Soviets' latest production knowledge. Organization followed American practices. Because of the technical nature of the product, the assistant director was the chief engineer and was in charge of inspection. There were departments headed by capable men handling personnel, inspection, processing, planning, engineering, purchasing, accounting, production, and distribution.

(d) War damage and special problems.—Before the war the majority of the factories manufacturing communications equipment were in the actual fighting zone or in the area subject to air attack. The entire radio industry had to be evacuated from Leningrad in the fall of 1941. Much equipment was lost during the transfer due to German air attacks on shipping on Lake Lodoga. The cable plant there apparently was not evacuated and was partly damaged but it subsequently was repaired and expanded. The extent of damage to other signal equipment buildings in Leningrad is not known, nor are details available on the effect of air raids on Moscow communications plants. The Voronezh radio receiver works was in ruins in 1945, but was reported again in production in May, 1946. The radio receiver factory in Kiev was under reconstruction in 1944, and production has since been resumed there, as well as at the Rīga and Minsk radio plants. Most of the present equipment for the Minsk plant was brought from Germany. In Khar'kov, destruction in general was thorough; three signal equipment plants there were reported evacuated. In 1946, in the fourth Five-Year Plan, it was stated that research institutes were to be reconstructed and new ones built.

The lack of sufficient technicians and engineers is considered by United States electronics engineers to be the Soviets' main problem in present production of communications equipment. This liability is apparent in the production of parts, vacuum tubes in particular. Several years ago the number of defective tubes amounted to 30% to 40% of the total produced, as compared with a little over 2% in Germany. There is no shortage of able men in the research field, and the factory workers could be trained to produce efficiently if there were enough foremen and technicians to supervise them. The Soviets are well aware of this limitation on the quality and quantity of the industry's output, and are attempting to overcome the difficulty by importation of German scientists and technicians and by a new educational program.

In the signal equipment field, conversion to military production and reconversion to civilian output is comparatively easy, requiring only about two weeks in the case of many products. In World War II, however, Soviet conversion was complicated by the necessity for evacuating plants and research institutions, by the loss of personnel and equipment, and by the difficulties which arose in coordinating the work of the evacuated laboratories, of the military headquarters in Moscow, and of the factories in their new locations. The extent to which reconversion has been accomplished since the war is not known.

In World War II the inadequate capacity of the industry, coupled with the concentration of its factories in Leningrad and Moscow, proved a tremendous handicap. It became necessary to evacuate most of the Leningrad plants and

many of those in Moscow, as well as the research laboratories from both cities. Much equipment was lost, and many workers killed in the evacuation from Leningrad. In addition, there was a time lag of some months (four months, in one case), between dismantling and commencement of manufacture in the new locations. As a result, the output declined in 1942, and the acquisition of lend-lease machinery and equipment proved of inestimable value in filling the gap. Although the present concentration of plants in the Moscow-Leningrad area is not so high as before the war, because of wartime evacuation and over-all expansion of the industry, it still represents a potential weakness. Also, the present capacity of the industry, so far as it can be gaged from available information, is not great enough to support large-scale military operations.

Another serious deficiency is the lack of sufficient numbers of skilled personnel. The policy of having single plants in which the various components were manufactured and then assembled into the finished product is another weakness which came to light in the war. Having recognized the inefficiency of this system, the Soviets have begun to follow the United States' example of having separate plants for the manufacture of one or more types of components, and for assembly of finished products.

Recent reports indicate that the Soviets are constructing new electronics factories underground, but no further information is available.

(13) Local industry and producers' cooperatives

(a) Definition and general location.—Local industry is that part of the industrial structure which comes under local jurisdiction, in contrast to that which is directly under national or republic control. Local and cooperative industry, on account of its relatively simple nature and because it is chiefly devoted to production of consumer goods, is more widely distributed than national or republic industry. Nevertheless, the main development is found in the Central Industrial Region, the Ukraine, and in Leningradskaya Oblast'. The products that can be spared move eastward, resulting in a gradually diminishing supply, as one progresses away from the manufacturing centers.

(b) Production.—Information on production by local industry and producers' cooperatives is too incomplete and confusingly stated to present any definite figures for either the USSR or the European zone. However, some idea of the importance of these two groups in the over-all production scheme of the USSR may be gathered from TABLE IX-68, based on prewar conditions.

TABLE IX - 68

PROPORTION OF PRODUCTION CONTRIBUTED BY LOCAL INDUSTRY AND PRODUCERS' COOPERATIVES, USSR

USSR industry	Local industry	Producers' cooperatives
	Percent	*Percent*
All industry	9	11
Metal processing	40	under 1
Chemicals	17	under 1
Building materials	12	unknown
Glass and porcelain	12	unknown
Fuel	1	unknown
Furniture	unknown	35
Clothing	unknown	33
Shoes	unknown	30
Metal consumer goods	unknown	42

Certain types of goods, such as needlework, scissors, various kinds of kitchen ware, toys, and musical instruments are manufactured almost exclusively by cooperatives. It is estimated that from 70% to 75% of the total output of local industry and producers' cooperatives is found within European USSR.

According to provisions set forth in the law of the fourth Five-Year Plan, the chief functions of the local industries and industrial cooperatives will be to produce consumer goods and local building materials; in addition, harness, carts, sleighs, and various simple types of horse-drawn and hand-operated machines will be manufactured for the collective and state farms. The Plan also provides for the following increases over prewar production.

	PERCENT
Furniture	30
Knitted goods	25-30
Brick	110
Peat	64
Coal	77

The severe shortage in consumer goods and recent drives to improve production point to inadequate progress of both local industry and producers' cooperatives. In November 1946 a decree was promulgated declaring that production of consumer goods by cooperatives should be greatly expanded. Implementation was to be effected by making available to cooperatives additional quantities of raw materials and equipment. More recently (February 1947) figures released by the State Planning Commission showed that local industry fulfilled its plan in 1946 by 102 percent. Although this contrasted favorably with the progress shown by many other industries, the goals for consumer goods were much more conservative than those for producer goods, so that actually the showing made was not impressive.

(c) List of plants and products.—No list of plants operating as part of the local industry or producers' cooperatives has been tabulated, since the data available are extremely limited. The wide activities in which local industries and cooperatives are engaged are listed in TABLE IX-69.

TABLE IX - 69

PRODUCTION BY TYPES—LOCAL INDUSTRY AND PRODUCERS' COOPERATIVES

Industry	Products
Building materials	Brick, tile, glass, lumber.
Chemicals	Plastics and probably industrial chemicals and pharmaceuticals.
Electrical products	Household appliances, radios.
Food products	Bakery products, macaroni, meat, fish, confectionery, animal and vegetable oil.
Fuel	Wood, peat, coal.
Glass and porcelain	Glassware and chinaware, window glass.
Leather products	Shoes, harness and other leather goods.
Metal goods	Iron and steel mill products, industrial chains, agricultural implements and simple machines, household furniture, stoves, aluminum and iron kitchenware, table utensils, costume jewelry.
Textiles and related products.	Cotton, woolen and linen fabrics, hosiery, knitted goods, felt boots, lace, needlework, rugs.
Wood and paper products	Lumber, furniture, wooden utensils, wagons, sleighs, footwear, toys, pencils, musical instruments, and books.

The semifinished products, which are turned out, undoubtedly are used exclusively by the local or cooperative group for further processing.

(d) Typical plant.—The establishments which fall into the category of local industry and cooperatives oper-

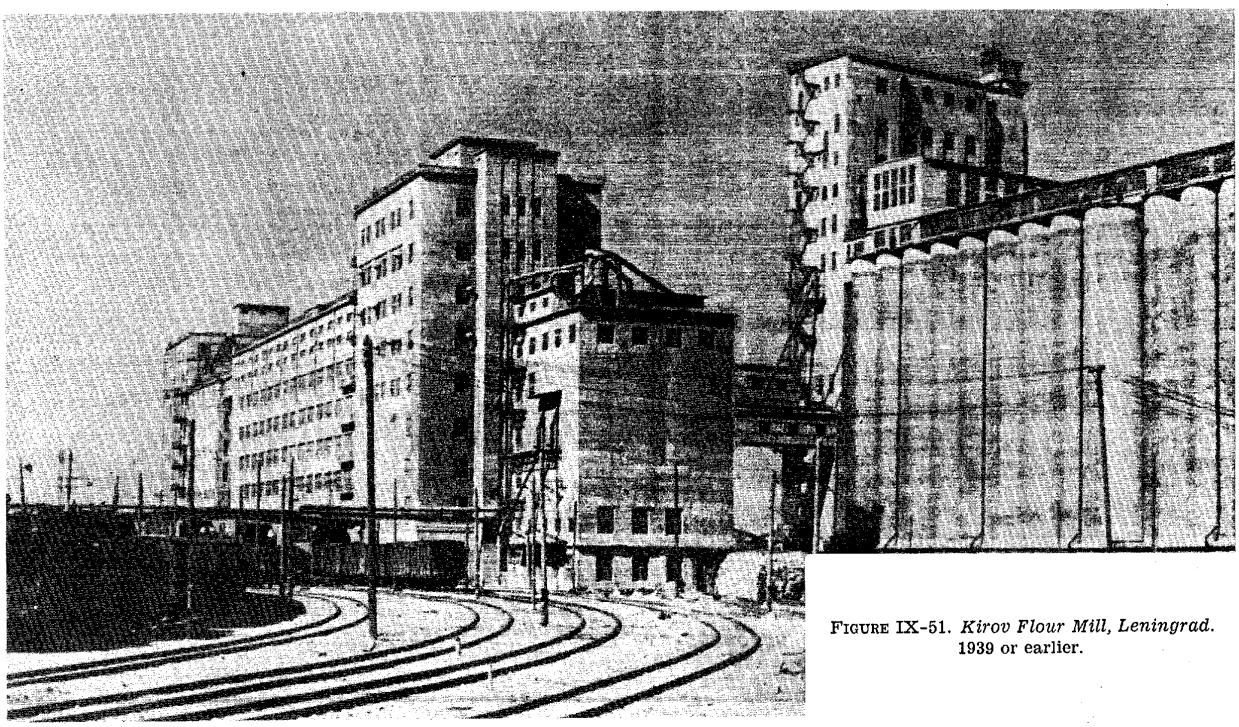


FIGURE IX-51. *Kirov Flour Mill, Leningrad.* 1939 or earlier.

ate on a relatively small scale. Therefore, individual plants are smaller, mechanization is not so extensively developed, and processes are less involved than in the plants under a higher jurisdiction. The most important form of the producers' cooperative is the *artel,* which consists of a central working establishment and the workers who assemble there. These *artels* sometimes embrace several hundred workers. Cooperatives are likewise formed of individual artisans, who pursue their trade in their homes. In addition, there is a special type of cooperative which utilizes disabled veterans and invalids. The Soviet cooperatives bear little resemblance to their counterparts elsewhere, since they are formed for furthering the interests of the state rather than individual groups.

(e) War damage and special problems.—The full effect of the past war on local and cooperative industry is difficult to assess since few facts dealing with this aspect have come to light. As a considerable portion of these industries were located in the Ukraine and the invaded sections of the Central Industrial and the Northwest Regions, the physical damage to buildings and equipment, without doubt, was very substantial. Moreover, other equipment and labor must have been lost to the war industries. Therefore, the major tasks which now confront local and cooperative industry are the rebuilding and reoutfitting of the plants, together with the replenishment of the labor force. While the simplified form of these establishments will render them easily reparable, the speed with which they are restored will depend primarily on how much effort the Soviet government feels obliged to detach from higher priority objectives.

(14) Storage facilities (FIGURES IX-51 and IX-52)

(a) General.—The fourth Five-Year Plan provides for the accumulation of large stocks of raw materials for military emergencies, and of food, the most important type of stockage for the national economy.

Warehouse and storage facilities are not as well developed in the Soviet Union as in Western countries. In 1937 the total storage capacity for all types of agricultural products in the USSR was 29.5 million metric tons. Of this total

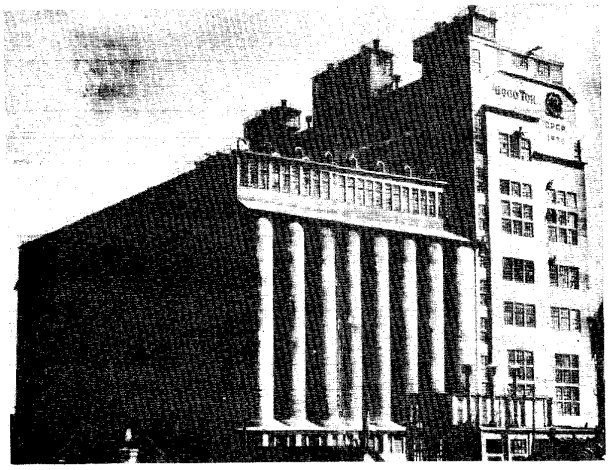


FIGURE IX-52. *Grain elevator, Nikolayev. 1930.*

only 4.8 million metric tons of capacity were in mechanized warehouses. The number of grain elevators was 662 in 1938 and their total capacity was 3.53 million metric tons. By far the greater proportion of these facilities was in European USSR. The third Five-Year Plan emphasized the need for increasing the amount of storage space and the particular need of increasing the number of grain elevators. The outbreak of the war prevented the execution of these plans and existing facilities were damaged during the war. As a result, present-day facilities are known to be most inadequate and are described as primitive. The net loss each year of the stored crop is much higher than that in the United States on similar sized storage. The loss is always explained as being due to very primitive and inadequate facilities.

There are few refrigerated warehouses in the Soviet Union and they are found only in the largest cities.

Fuel storage consists in open air stockpiling of wood, coal, peat, and lignite; storage of natural gas in conven-

TABLE IX - 70

STORAGE INSTALLATIONS

Location	Number of installations	Remarks
North:		
RSFSR:		
Arkhangel'skaya O	3	Powder, ammonal, and ammunition storage.
Leningradskaya O	22	Military depots, including 6 underground and 5 in connection with Kronshtadt naval yard. All types of arms, ammunition vehicles, and equipment.
West:		
Lithuanian SSR	10	Includes three military depots in old forts at Kaunas; other military depots; and 4 large R.R. depots.
White Russian SSR	2	An ammunition depot and R. R. warehouse.
South:		
RSFSR:		
Kuybyshevskaya O	6	Includes 4 explosives depots and 2 army depots.
Saratovskaya O	6	Includes underground ammunition dump, motor-vehicle depot and 4 chemical-warfare depots.
Stalingradskaya O	3	Fuel and explosives storage, including underground warehouses.
Tatar ASSR	3	Arsenals for arms, ammunition, and equipment.
Ul'yanovskaya O	2	Military depot and well-camouflaged underground materiel depot.
Gor'kovskaya O	8	Vehicle, ammunition, equipment and ration depots.
Kalininskaya O	1	Artillery depot.
Kirovskaya O	1	Weapons, ammunition, clothing.
Mordovian ASSR	1	Ammunition dump, underground.
Moskovskaya O	11	Includes 4 underground ammunition depots, with underground departments; and Air Force depot; a large artillery arsenal and 4 army depots.
Penzenskaya O	2	Storage of weapons, aircraft engines, rations, and uniforms in brick buildings and iron-roofed underground installations.
Ryazanskaya O	1	Weapon and ammunition depot.
Tul'skaya O	4	Scattered small army depots.
Vladimirskaya O	2	Army depot. Food and clothing.
Voronezhskaya O	1	Army depot. Ammunition.
Yaroslavskaya O	10	Army ammunition and materiel, including 2 chemical-warfare depots and 1 Air Force depot.

tional steel cylinders or in underground chambers and stockage of gasoline and fuel oil in steel tanks, earthenware tanks, and underground reservoirs.

Metal oil and gasoline storage tanks with a capacity of over two million cubic meters were destroyed by the Germans. These were located at 720 storage points. Underground storage is especially common at airports.

The best detailed information of Soviet storage facilities is available on armaments and munitions depots. These installations are generally camouflaged and buildings may be dispersed in wooded areas. When conventional structures are utilized buildings generally are erected in groups of 10 to 20, and are of single-story brick or stone construction. Former churches and monasteries were widely utilized as warehouses. For storage of all types of military stores, underground depots exist. These vary from simple excavations in hills or ridges, with sheet-iron roofing, to deeper and more heavily protected installations of reinforced concrete. Following universal practice, ammunition and explosives are stored in scattered, 10-foot concrete bunkers, covered with earth. This type of storage facilitates the maintenance of uniform temperatures and minimizes loss when explosions occur.

(b) Installations.—Known installations are listed by oblast within Soviet economic regions in TABLE IX-70.

98. COMMERCE AND FINANCE

A. Commerce

(1) General

Internal and external trade in the USSR must be considered in the light of two determining facts: 1) the Soviet Union has a socialistic economy in which all forms of production are state-owned and all trade is state-controlled; 2) the USSR has a totalitarian political regime which places the needs of the state above the needs of its citizens. Therefore consumer desires are a minor consideration in the import program of the country. Industrial development, and resulting increase in war potential, are of primary importance.

Because of this basic economic situation, the nature of available information, and the dominant position of European USSR in the Soviet population and total economy, this section deals with commerce on a national basis rather than in terms only of European USSR.

(2) Foreign trade

Briefly, the foreign trade program of the USSR is as follows: the State Planning Commission (Gosplan) accords priorities to certain industries; first priorities for imports go to industries which increase war potential, such as metallurgy, machine tools, chemistry, and transport. The ministries concerned with the various industries and agriculture submit to the Gosplan estimates of their future exportable surplus. Their calculations are based on past production records plus the quantities estimated to be available in the future, considering increase and expansion of plant capacity and growing industrial efficiency. These estimates are coordinated by Gosplan; existing price contracts and world price fluctuations are taken into consideration; and a minimum amount which is likely to be realized on all exports is finally determined. To this figure are added the country's estimated gold production and the foreign exchange likely to be received from goods and services rendered representatives of the foreign press and diplomatic corps. From this total all external debt payments due within a given year are deducted, including salaries of foreign specialists whose contracts call for payment of salaries in foreign currency. The balance establishes the limit of foreign purchases to be made abroad by the Ministry of Foreign Trade. The amount that will be available is then apportioned among the various branches of the national economy according to the above-mentioned priorities accorded the various ministries in the Five-Year Plan. Commitments are segregated according to the years

TABLE IX - 71

TOTAL USSR EXPORTS AND IMPORTS,* 1929 TO 1938

Year	Exports				Imports			
	Agricultural		Industrial		Consumption goods		Production goods	
	Million rubles	*Percent of total*	*Million rubles*	*Percent of total*	*Million rubles*	*Percent of total*	*Million rubles*	*Percent of total*
1929	1,572. 1	38. 8	2,473. 7	61. 2	394. 2	10. 2	3,407. 6	88. 4
1930	1,899. 0	41. 8	2,640. 3	58. 2	455. 0	9. 8	4,083. 5	88. 1
1931	1,499. 1	42. 1	2,054. 0	57. 9	222. 5	4. 6	4,503. 1	93. 0
1932	803. 4	31. 9	1,714. 8	68. 1	250. 5	8. 1	2,752. 4	89. 3
1933	623. 9	28. 8	1,543. 6	71. 2	79. 7	5. 2	1,385. 8	90. 3
1934	521. 3	28. 4	1,311. 1	71. 6	157. 2	15. 4	860. 8	84. 6
1935	429. 9	26. 7	1,179. 4	73. 3	136. 6	12. 9	920. 6	87. 1
1936	275. 4	20. 3	1,083. 7	79. 7	142. 5	10. 5	1,210. 0	89. 5
1937	547. 6	31. 7	1,181. 0	68. 3	121. 5	9. 1	1,219. 8	90. 9
1938	485. 5	36. 4	846. 4	63. 6	172. 1	12. 1	1,250. 8	87. 9

*Agricultural and industrial exports are classified according to the official usage of the Soviet statistical publications on foreign trade. Classification of imports into consumption and production goods is based upon official sources which did not classify all commodities into these two groups every year, with the result that for certain years the total does not add up to 100 percent.

in which they fall due. All payments falling due in the year in which orders are placed are kept strictly within the prescribed limits. Import transactions are made by Soviet state trade corporations in foreign countries (e.g. Amtorg in New York) with a margin of safety that is usually ample.

In the Soviet view, there are many advantages to state trading as opposed to the free enterprise system of capitalist countries. It is held that export and import plans can be adjusted to world conditions with a rapidity and accuracy impossible for individual capitalist traders. If estimates of Soviet exports for the current year show a considerable shrinkage in value, it is expected that the government can readjust them by pushing production of more profitable lines or by dumping, with the resulting losses to be absorbed elsewhere. If these measures do not suffice, purchases abroad are immediately curtailed, and thus no obligations are incurred which cannot be met. This arrangement is especially necessary as Soviet currency is not quoted on foreign exchanges, and the export of currency is strictly prohibited. In the prewar period, large gold shipments offset adverse balances of trade.

Conditions during and since World War II have precluded normal Soviet trade relations with other nations. Extensive war damage and political considerations have determined the nature and direction of Soviet postwar trade. On the other hand, lend-lease supplies, UNRRA aid, reparations in money, and goods from defeated nations have all supplied Soviet needs which would ordinarily be supplied through foreign trade. A period of ten years (1929-1938) is used to illustrate Soviet foreign commerce under more normal world-trade conditions. The Soviet trade objectives during this period were primarily: 1) self-sufficiency; 2) effective governmental monopoly of foreign trade; 3) retaliation against anti-Soviet measures of other nations, both economic and political; 4) obtaining credit; and, 5) economic penetration of neighboring countries with political as well as economic motives.

To attain the goal of autarchy, the USSR's imports during this period (1929-1938) were chiefly capital goods equipment and manufactured goods, which would eventually make the country industrially self-sufficient (TABLES IX-71 and IX-72). Foodstuffs, raw materials, and semimanufactures, timber and lumber products, grains, oil and oil products, and furs were the main items of export in this prewar period (TABLE IX-73). Soviet commercial policy during this era is summed up by the following statement in the *Economic Handbook of the Soviet Union,* published in 1931 by the American-Russian Chamber of Commerce:

> The foreign trade of the Soviet Union is carried on in accordance with a program which is an integral part of the general plan of economic development. Its purpose is to further the interests of national construction by supplying those products, chiefly equipment and raw and semimanufactured material which the development of the country demands. For this reason, the leading part in foreign trade is assigned to imports, the export of goods serving only as a means for the fulfillment of the import program. It is only to the extent that the USSR requires imported goods that its internal resources are used for export.

TABLE IX - 72

CLASSIFIED IMPORTS, ALL USSR, 1929-1938

Year	Animals		Foodstuffs		Raw materials and semi-manufactures		Manufactures		Total (100 percent)
	Million rubles	*Percent of total*	*Million rubles*	*Percent of total*	*Million rubles*	*Percent of total*	*Million rubles*	*Percent of total*	*Million rubles*
1929	55. 4	1. 4	322. 4	8. 4	1,681. 9	43. 6	1,797. 9	46. 6	3,857. 0
1930	99. 1	2. 1	414. 3	8. 9	1,171. 7	25. 3	2,952. 4	63. 7	4,637. 5
1931	114. 9	2. 4	204. 8	4. 2	930. 3	19. 2	3,589. 9	74. 2	4,839. 9
1932	81. 2	2. 6	232. 2	7. 5	507. 3	16. 5	2,262. 8	73. 4	3,083. 5
1933	59. 5	3. 9	69. 4	4. 6	388. 6	25. 5	1,007. 6	66. 0	1,525. 1
1934	47. 6	4. 7	95. 3	9. 4	396. 2	38. 9	478. 9	47. 0	1,018. 0
1935	41. 1	3. 9	92. 3	8. 7	464. 1	43. 9	459. 7	43. 5	1,057. 2
1936	54. 9	4. 1	88. 2	6. 5	472. 6	34. 9	736. 8	54. 5	1,352. 5
1937	46. 1	3. 4	85. 9	6. 4	669. 0	49. 9	540. 3	40. 3	1,341. 3
1938	53. 6	3. 8	128. 3	9. 0	563. 4	39. 6	677. 7	47. 6	1,422. 9

TABLE IX - 73

CLASSIFIED EXPORTS, USSR, 1929–1938

Year	Animals		Foodstuffs		Raw materials and semi-manufactures		Manufactures		Total (100 percent)
	Million rubles	*Percent of total*	*Million rubles*	*Percent of total*	*Million rubles*	*Percent of total*	*Million rubles*	*Percent of total*	*Million rubles*
1929	12. 1	0. 3	857. 7	21. 2	2,536. 7	62. 7	639. 3	15. 8	4,045. 8
1930	0. 1	0. 0	1,434. 4	31. 6	2,414. 9	53. 2	690. 0	15. 2	4,539. 3
1931	0. 0	0. 0	1,250. 7	35. 2	1,694. 8	47. 7	607. 6	17. 2	3,553. 1
1932	0. 0	0. 0	566. 6	22. 5	1,347. 2	53. 5	604. 4	24. 0	2,518. 2
1933	0. 1	0. 0	411. 8	19. 0	1,260. 2	58. 1	495. 4	22. 9	2,167. 5
1934	0. 2	0. 0	295. 8	16. 1	1,104. 4	60. 3	432. 0	23. 6	1,832. 4
1935	0. 2	0. 0	305. 2	19. 0	997. 1	62. 0	306. 8	19. 0	1,609. 3
1936	0. 1	0. 0	182. 0	13. 4	907. 7	66. 8	269. 3	19. 8	1,359. 1
1937	0. 1	0. 0	396. 6	22. 9	1,012. 1	58. 6	319. 8	18. 5	1,728. 6
1938	0. 1	0. 0	406. 4	30. 5	671. 6	50. 4	253. 8	19. 1	1,331. 9

In the postwar period it can be assumed that Soviet foreign trade will continue to be directed toward the desired goal of full industrial self-sufficiency.

(3) Internal commerce

(a) Interregional flow of commodities.—In drawing up the economic plans for the Soviet Union the State Planning Commission (Gosplan) directs and allocates the flow of commodities within the USSR from surplus to deficient areas. For example, the industrial Moscow area which is deficient in foodstuffs is partially fed from normally food surplus areas such as the Ukraine and White Russia. The latter two republics in turn are partially dependent on the manufacturing areas like Moscow and the Urals region for machinery and consumer goods. However, when temporary food shortages occur in normally food surplus areas the government does not always take steps to alleviate local suffering by revising the national plan of food distribution as this would involve diminishing the food allotments of the vital industrial areas which might, in turn, result in the under-fulfillment of quotas set for industrial production.

(b) Retail trade.—The retail distribution of foodstuffs and consumer goods in the USSR is accomplished through the following outlets: 1) state-owned ration stores; 2) state-owned commercial stores; 3) state-owned commission shops; 4) cooperative stores; 5) various open markets.

The ration stores, as the name implies, furnish the Soviet citizen with his meager ration of goods at relatively reasonable prices, even considering the 300% rise in the price level of rationed foods during 1946. Food rationing in the Soviet Union will continue in 1947, even though the grain yield in 1946 was superior to that of 1945. The continuation of the ration is due to the difficulty of distribution owing to the inadequate transportation system, and to the replenishment of military stockpiles depleted during the war.

The commercial stores are in the luxury class, and although they sell foodstuffs, clothing, etc., the prices in these stores are beyond the reach of the citizen with an average income. Simultaneously with the increase in the prices of rationed foods the prices in the commercial stores were somewhat reduced, but not proportionately. This is the initial step toward the eventual resumption of a one-price system.

The commission shops deal with the sale of second-hand items brought to the store by individuals desiring to convert their possessions into cash. For handling these transactions the government deducts a stated commission from the sale price. In type and variety of goods handled the commission shops resemble the American pawn shop.

To stimulate the production and marketing of consumer goods the Soviet Government has recently been encouraging the organization and expansion of producing and distributing cooperatives. Although this move has received widespread propaganda, reports have indicated that the cooperatives are having only a slight effect on the grim consumer goods situation.

Several trade outlets are included under the term, open market. Among these are the produce markets where members of collective farms are allowed to sell crop surpluses which are not requisitioned by the government or needed for consumption on the collective farms. A variation of the produce market is the barter-type market which combines produce sale, or exchange, with individual bartering of all varieties of goods. The prices in these open market types tend to be set by the prevailing prices in the black market. Black market operations are widespread in the Soviet Union and have tacit governmental approval. The black market prices for items found in commercial stores are slightly lower than the commercial store prices, but on other goods not available through any of the state-owned stores, the black market prices are as high as the traffic will bear.

B. Finance

(1) Currency

The monetary unit of the USSR is the ruble (*rubl*, symbol R) which is divided into 100 Kopecks (*Kopeika*). One *chervonets* (plural: *chervontsy*) equals ten rubles. When the Soviet Union currency was stabilized in 1924, after the run-away inflation of the postwar years, the chervonets was introduced as the monetary unit. However, in later years the use of the chervonets has been largely discontinued and all government data, including those of the State Bank, have been published in rubles.

Data on monetary circulation have not been divulged since 1 January 1937. At the end of 1936, money in circulation was as follows:

	Million Rubles
State Bank notes	8,020
Treasury notes	2,801
Auxiliary coins	435

The Gosbank (Russian abbreviation for *Gosudarstvenny Bank* - State Bank) is the Central Bank of the USSR. In 1924, the Bank was placed under statutory obligation to maintain a 25% metallic cover of its note cir-

culation. In the years 1928-34, this ratio was on the whole well maintained. It fell below the statutory level in 1935 but was restored again through the devaluation of the ruble in 1936, when the gold reserve was revalued and that part of it which was in excess of 25% was added to the gold holdings of the Treasury (then the USSR People's Commissariat of Finances, now the Ministry of Finances). In the special conditions of the Soviet economy, with its strict monetary controls, the maintenance of a statutory gold reserve has little economic significance. In situations of considerable inflationary pressure, it is conceivable that the government might employ its gold reserves for anti-inflationary purposes by using them for import of consumer goods. There is no evidence that the gold reserve has ever been used for this purpose.

The Act of 1924 also provided for the issue of treasury notes. Circulation of the latter was originally limited to 50% of the bank note circulation. This limit was subsequently expanded to 75% and finally, on 18 September 1930, to 100% of the bank note circulation. As shown in the tabulation of money in circulation, the value of treasury notes in circulation amounted, in 1936, to about 35% of the value of bank notes in circulation. In general, bank notes are issued in relatively high, and treasury notes in relatively low, denominations. The issue of treasury notes is also handled by the Gosbank.

(2) Foreign exchange value of the ruble

When the ruble was stabilized (1924), the value of the ruble (as one-tenth of one chervonets) in relation to the dollar was established at the prewar level of one ruble equals 51.46 pre-1933 United States gold cents. For a few years the ruble was quoted in foreign markets. In 1926, however, as a result of the difficulty of maintaining the foreign value of the ruble, exports of the currency were prohibited. Two years later, in 1928, a prohibition against imports of rubles into the USSR made the system of exchange control water-tight and divorced the external value of the ruble from its internal value. Since that time the organs of the Russian Monopoly of Foreign Trade have made and received all payments to and from foreign countries in foreign exchange. The ruble has accordingly become essentially a domestic currency; except for such relatively minor items as tourist expenditures in, and emigrant remittances to, the USSR, its foreign rate of exchange has been purely nominal.

The aforementioned nominal value of the ruble was maintained until early in 1936. In the intervening years, a considerable price inflation took place and the discrepancy between the official rate of exchange and the internal purchasing power of the ruble became very great. While this discrepancy had little, if any, effect on the volume of foreign trade transactions, it was considered undesirable because it involved large bookkeeping losses and profits. Moreover, the abolition of rationing at the end of 1935 was accompanied by a rise in prices of consumer goods and at the same time the special *Torgsin* stores (Russian abbreviation of *Torgovlya s inostrantsami* - trade with foreigners), which sold goods for foreign exchange, were abolished. Maintenance of the official rate of exchange would have exerted an unfavorable effect on foreigners' expenditures in Russia and on remittances from abroad.

Accordingly, on 1 April 1936, the ruble was devalued by 77.18% and a new official rate of exchange of one ruble to three French francs was established. Since the United States dollar at the time was equal to roughly 15 French francs, the dollar-ruble cross-rate was thus approximately five rubles to one post-1933 United States dollar. The ruble - French franc rate was changed on 27 October 1936, to one ruble to 4.25 French francs in order to take into account the devaluation of the franc. On 19 July 1937, an official rate of 5.30 rubles to one dollar was established, which implied a further devaluation of the ruble by about 5 percent.

The peculiarities of the Soviet price system make it difficult to compute a purchasing-power-parity rate of exchange for the ruble. According to a tentative estimate, a rate of eight rubles to the dollar would have reflected more correctly the purchasing power of the ruble in 1938. It is virtually impossible to provide a similar estimate for the war years or for the period immediately following. During the war, a diplomatic rate of exchange of 12 rubles to the dollar was set, later supplemented by the so-called military rates of 18 rubles to the dollar. These changes purported to compensate for the rise in prices of such goods as were sold to Allied representatives in the USSR. From about the middle of 1944 prices of nonrationed commercial goods began to decline. This development has continued up to date. According to computations based on the data of the fourth Five-Year Plan, retail prices at the beginning of 1946 were still about 23% higher than in 1940. This information, referring as it does to a mere segment of the price system, is, of course, insufficient for measurement of the over-all price situation.

(3) Banking system

(a) Central Bank.—The *Gosbank* (State Bank), which has a network of more than three thousand branches throughout the country, acts as a center for clearing operations and is the source of short-term credit to the economy. All enterprises of the USSR are under obligation to keep their cash reserves with the Gosbank. The individual enterprises do not grant credits to each other. The short-term credits of the Gosbank are granted for specific purposes such as the purchase of raw materials. They are repayable and appropriate security must be pledged against them. The upper limits of short-term credits to individual enterprises are established in accordance with the General Economic Plan. The Gosbank supervises the utilization of short-term credits by the enterprises as well as transactions between two enterprises where the Gosbank has been called upon to transfer funds from the account of one enterprise to that of the other. Thus the Gosbank is a powerful factor in checking the execution of the Plan by the enterprises.

(b) Investment banking.—Long-term investment of budgetary funds and funds accumulated by individual enterprises in the economy is channeled through four All-Union banks.

1) The *Prombank* (Industrial Bank) finances investment in industrial enterprises, transportation, and also in factory housing projects.
2) The *Torgbank* (Commercial Bank) finances capital investment in state trading organizations as well as in consumers' and producers' cooperatives.
3) The *Tsekombank* (Central Municipal Bank) distributes funds for municipal investment in such projects as public utilities, housing, and others.
4) The *Selkhozbank* (Agricultural Bank) serves machine-tractor stations, state farms, and the kolkhozy (collective farms).

These banks not only distribute the funds in accordance with the Plan but also supervise its execution. The Central Municipal Bank acts through local municipal banks. The other three banks have a wide network of their own local branches.

The funds provided to state-owned organizations by these banks are nonrepayable subsidies. Accordingly, no interest is charged. On the other hand, funds supplied to the

collective farms and to the various cooperatives represent long-term credits for which interest payments must be made.

At the same time, all four banks have limited functions in granting short-term credits for certain specified purposes. These functions are supplementary to those exercised by the Gosbank.

(c) Saving institutions.—During the war, the Gosbank began to accept savings from large-scale depositors. The bulk of savings, however, is accepted by special saving institutions (*Sberkassy*). All savings deposits earn interest and are released on demand.

99. PRINCIPAL SOURCES

A. Principal sources for Topics 91 and 92

(1) Evaluation for Topics 91 and 92

Note: The numbers used in the following text refer to the list of references (Subtopic (2)).

Detailed statistical data on crop acreages and number of livestock are available through 1938. The figures published since that time, and particularly since the beginning of the war, have been much more fragmentary in character, often given in the form of percentages of a base which is not known, rather than in actual hectares or numbers of animals. Territorial changes, which have taken place since the war, not only through incorporation of new territories into the Soviet Union but also through the reshuffling of administrative divisions within the old frontiers of the USSR, also make comparison of postwar and prewar data extremely difficult. However, the official Soviet statistics of crop acreages and livestock numbers, published through 1938, are considered reliable enough to be used without correction or adjustment. They were probably less affected than yield estimates by frequent changes which have characterized the Russian statistical machinery of the last 20 years.

The situation is quite different, however, with respect to yields per acre, which must be determined for each crop and multiplied by the area sown in order to obtain production figures. Since 1933, the Russian grain yields have not been strictly comparable with those for the preceding years, or with those for other countries. In Russia, prior to 1933, and in all other countries, including the United States, the yield figures apply to harvested grain, or so-called barn yields. However, the official yield figures published in the USSR are those of the standing crop, estimated approximately a week before the harvest, and do not include harvesting losses, which are as large as 10% to 20% or more. This method of estimating yields has been applied to grains since 1933 and, in later years, apparently was extended to other crops. Little, however, is known about the operation of this system in the case of crops other than grains. With respect to grains, there is enough evidence to indicate definite overestimation since 1933 of official yield data and, consequently, of production figures, which makes it impossible to use them in comparisons with other countries or with Russian figures prior to 1933.

The collective farms pay the state-owned machine-tractor stations a certain quantity of the crop per hectare (2,471 acres), which varies with the yields for the district as a whole. The higher the officially estimated yield per hectare, the larger the rate paid to the machine-tractor station. Theoretically, the machine-tractor stations are supposed to raise yields by improving farm practices. Therefore, this is an additional incentive to over report yields. There is no direct evidence that this is done; in fact, little specific information has been published on actual methods of crop estimating. Nevertheless, the fact that the extraction of as much grain as possible from the farmer has always been a pivotal objective of the Soviet agricultural policy would favor the tendency toward overestimation. It would likewise have a fine propaganda value in demonstrating the superior productivity of the collective farms over the supplanted individual peasant holdings. Caution, therefore, is required in dealing with official Soviet crop figures, especially of grains, which were scaled downward in TABLE IX-13.

(2) List of references

(a) Russian sources

1. Demidov, S. F.
   RAZVITIE SELSKOVO KHOZYAISTVA V POSLEVOENNOI PYATILETKE (Development of Agriculture in the Postwar Five-Year Plan). Moscow. 1946.
2. ———
   ENTSIKLOPEDIYA RUSSKOVO EKSPORTA (Encyclopedia of Russian Exports). Berlin. 3 vols. 1925.
3. Flyaksberger, K. A.
   PSHENITSY (Wheats). Moscow and Leningrad. 2nd ed. 1938.
4. Gaister, A. I., ed.
   SELSKOKHOZYAISTVENNY SLOVAR-SPRAVOCHNIK (Agricultural Reference Dictionary). Moscow and Leningrad. 1934.
5. Laptev, I. D.
   RAZMESHCHENIE SOTSIALISTICHESKOVO ZERNOVOVO KHOZYAISTVA. (Geographical Distribution of Socialist Grain Farming). Moscow. 1940.
6. Milyutin, V. P., ed.
   SELSKOKHOZYAISTVENNAYA ENTSIKLOPEDIYA (Agricultural Encyclopedia). Moscow. 4 vols. 1932-35.
7. ———
   SELSKOE KHOZYAISTVO SSSR EZHEGODNIK 1935 (Agriculture of the USSR: 1935 Yearbook). Moscow. 1936.
8. Narodny Komissariat Vneshnei Torgovli (People's Commissariat of Foreign Trade)
   VNESHNYAYA TORGOVLYA SOYUZA SSR STATOBZOR DEKABR 1934-38 (Foreign Trade of the USSR. Statistical Review, December 1934-38). Moscow. (Monthly, December issue gives summary for the year.)
9. Nemchinov, V. S.
   SELSKOKHOZYAISTVENNAYA STATISTIKA S OSNOVAMI TEORII (Agricultural Statistics with Principles of General Statistical Theory). Moscow. 1945.
10. Nifontov, V. P., ed.
    ZHIVOTNOVODSTVO SSSR V TSIFRAKH (Animal Husbandry of the USSR in Figures). Moscow and Leningrad. 1932.
11. Pryanishnikov, D. N.
    AZOT V ZHIZNI RASTENII I V ZEMLEDELII SSSR (Nitrogen in the Life of Plants and in the Agriculture of the USSR). Moscow. 1945.
12. Pryanishnikov, D. N., and Yakushkin, I. V.
    RASTENIYA POLEVOI KULTURY (Field Crops). Moscow. 1938.
13. Regel, R. E.
    KHLEBA V RUSSII (Grains in Russia). Petrograd. 1922.
14. Sholts, S. V.
    KURS SELSKOKHOZYAISTVENNOI STATISTIKI (A Course in Agricultural Statistics). Moscow. 1945.
15. ———
    SLOVAR-SPRAVOCHNIK PO ZHIVOTNOVODSTVU (Reference Dictionary of Animal Husbandry). Moscow and Leningrad, 1935.
16. ———
    SPRAVOCHNIK DLYA RUKOVODYASHCHIKH RABOTNIKOV MTS I SOVKHOZOV (Reference Book for Managers of Machine Tractor Stations and State Farms). Moscow and Leningrad. 1935.
17. Tsentralnoe Statisticheskoe Upravlenie (Central Statistical Administration)
    STATISTICHESKII SPRAVOCHNIK SSSR ZA 1928 (Statistical Yearbook of the USSR for 1928). Moscow. 1929.

18. Tsentralnoe Upravlenie Narodnokhozyaistvennovo Ucheta Gosplana SSSR (Central Administration for Economic Statistics of the Gosplan of the USSR).
CHISLENOST SKOTA V SSSR (Numbers of Livestock in the USSR). Moscow. 1936.
19. Tsentralnoe Upravlenie Narodnokhozyaistvennovo Ucheta Gosplana SSSR.
KOLKHOZY VO VTOROI STALINSKOI PYATILETKE (Collective Farms in the Second Stalinist Five-Year Plan). Moscow and Leningrad. 1939.
20. Tsentralnoe Upravlenie Narodnokhozyaistvennovo Ucheta Gosplana SSSR.
MTS VO VTOROI PYATILETKE (Machine Tractor Stations in in the Second Five-Year Plan). Moscow and Leningrad. 1939.
21. Tsentralnoe Upravlenie Narodnokhozyaistvennovo Ucheta Gosplana SSSR.
POSEVNYE PLOSHCHADI SSSR 1938 G STATISTICHESKII SPRAVOCHNIK (Sown Area of the USSR in 1938: Statistical Yearbook). Moscow and Leningrad. 1939.
22. Tsentralnoe Upravlenie Narodnokhozyaistvennovo Ucheta Gosplana SSSR.
POSEVNYE PLOSHCHADI SSSR STATISTICHESKII SPRAVOCHNIK (Sown Area of the USSR: Statistical Yearbook). Moscow and Leningrad. 1939.
23. Tsentralnoe Upravlenie Narodnokhozyaistvennovo Ucheta Gosplana SSSR.
PRCIZVODITELNOST I ISPOLZOVANIE TRUDA V KOLKHOZAKH VO VTOROI PYATILETKE (Productivity and Utilization of Labor on the Collective Farms in the Second Five-Year Plan). Moscow and Leningrad. 1939.
24. Tsentralnoe Upravlenie Narodnokhozyaistvennovo Ucheta Gosplana SSSR.
SOTSIALISTICHESKOE SELSKOE KHOZYAISTVO SSSR STATISTICHESKII SBORNIK (Socialist Agriculture of the USSR: Statistical Review). Moscow and Leningrad. 1939.
25. Tsentralnoe Upravlenie Narodnokhozyaistvennovo Ucheta Gosplana PRI SNK SSSR. (Council of People's Commissars of the USSR).
SOTSIALISTICHESKOE STROITELSTVO SOYUZA SSR (1933-1938 GG) STATISTICHESKII SBORNIK (Socialist Construction of the USSR (1933-1938) Statistical Review). Moscow and Leningrad. 1939.
26. Tsentralnoe Upravlenie Narodnokhozyaistvennovo Ucheta Gosplana SSSR.
ZHIVOTNOVODSTVO SSSR ZA 1916-1938 GG (Animal Husbandry of the USSR during 1916-1938). Moscow and Leningrad. 1940.
27. ———
VAZHNEISHIE RESHENIYA PO SELSKOMU KHOZYAISTVU ZA 1938-1940 GODY (The Most Important Agricultural Decrees for 1938-1940). Moscow. 1940.
28. Vsesoyuzny Institut Rastenievodstva Narodnovo Komissariata Zemledeliya Soyuza SSR (All Union Institute of Plant Growing of the People's Commissariat of Agriculture of the USSR).
RASTENIEVODSTVO SSSR (Plant Growing of the USSR). Vol. 1, Part 1-2. Leningrad and Moscow. 1933.
29. Vsesoyuzny Institut Yuridicheskikh Nauk, N. K. Yu., SSSR. (All Union Institute of Juridical Science, People's Commissariat of Law, USSR).
KOLKHOZNOE PRAVO (Collective Farm Law). Moscow. 1939.
30. Vsesoyuznaya Selsko-Khozyaistvennaya Vystavka (All Union Agricultural Exhibition.)
POBEDY SOTSIALISTICHESKOVO SELSKOVO KHOZYAISTVA (Victories of Socialist Agriculture). Moscow. 1939.
31. ———
PLANOVOE KHOZYAISTVO (Planned Economy). Monthly Magazine. Moscow.
32. ———
SOTSIALISTICHESKOE SELSKOE KHOZYAISTVO (Socialist Rural Economy). Monthly magazine. Moscow.
33. ———
SOTSIALISTICHESKOE ZEMLEDELIE (Socialist Agriculture). Newspaper. Moscow.

(b) Other foreign-language sources

34. Tilastollisen Päätoimiston Julkaisema (Publication du Bureau Central de Statistique).
SUOMEN TILASTOLLINEN VUSOKIRJA Annuaire Statistique de Finlande. (Finnish Yearbook). Helsinki. 1934-40.
35. Riigi Statistika Keskbüroo (Bureau Central de Statistique de l'Estonie).
EESTI POLLUMAJANDUS STATISTILINE AASTARAAMAT. Annuaire de la Statistique Agricole. (Estonian Yearbook). Tallinn. 1934-39.
36. Valsts Statistika Parvalde (Bureau de Statistique de l'Etat).
LATVIJAS STATISTISKA GADA GRAMATA. Annuaire Statistique de la Lettonie. (Latvian Yearbook). Rīga. 1934-39.
37. Valsts Statistiska Parvalde (Bureau de Statistique de l'Etat).
LATVIJAS LAUKSAIMNIECIBA. Etat de l'Agriculture en Lettonie. (State of Agriculture in Latvia). Rīga. 1934-39.
38. Centralinis Statistikos Biuras (Central Bureau de la Statistique).
VISUOTINIS LIETUVOS ZEMES UKIO SURASYMAS. Recensement Agricole en Lithuanie. (Survey of Lithuanian Agriculture). Kaunas. 1934-39.
39. Glowny Urzad Statystyczny.
STATYSTYKA ROLNICZA. (Statistique Agricole.) (Agricultural Statistics: Poland). Warsaw. 1934-39.
40. Institutul Central de Statistica.
ANUARUL STATISTIC AL ROMANEI. (Rumanian Yearbook). Bucharest. 1934-39.

(c) English-language sources

41. Coleman, D. A., Dawson, Owen L., Christie, Alfred, Dixon, H. B., Fellows, H. C., Hayes, J. F., Hoffecker, Elwood, Shollenberger, J. F., and Marshall, W. K.
MILLING AND BAKING QUALITIES OF WORLD WHEATS (Technical Bull. No. 197, October 1930), U. S. Department of Agriculture. 1930.
42. Cooper, M. R., Holley, W. C., Hawthorne, H. W., & Washburn, R. S.
LABOR REQUIREMENTS FOR CROPS AND LIVESTOCK (Department of Agriculture, Bureau of Agricultural Economics, F. M. 40, May 1943). 1943.
43. Michael, Louis G.
AGRICULTURAL SURVEY OF EUROPE: THE DANUBE BASIN, PART 2, RUMANIA, BULGARIA, AND YUGOSLAVIA (Technical Bull. No. 126, October 1929). U. S. Department of Agriculture. 1929.
44. Royal Institute of International Affairs, Information Department.
THE BALTIC STATES. London. Oxford University Press. 1938.
45. Timoshenko, Vladimir P.
AGRICULTURAL RUSSIA AND THE WHEAT PROBLEM (Grain Economics Series No. 1, September 1932). Food Research Institute and the Committee on Russian Research of the Hoover War Library. Stanford, Cal. 1932.
46. Warriner, Doreen.
ECONOMICS OF PEASANT FARMING. London, New York. Oxford University Press. 1939.
47. Marbut, C. F.
AGRICULTURE IN THE UNITED STATES AND RUSSIA: A COMPARATIVE STUDY OF NATURAL CONDITIONS, Geographical Review, vol. XXI, no. 4, October 1931. pp. 598-612. 1931.
48. Tulaikov, N. M.
AGRICULTURE IN THE DRY REGION OF THE USSR, Economic Geography, vol. 6, no. 1, January 1930. pp. 54-80. 1930.
49. U. S. Department of Agriculture, Office of Foreign Agricultural Relations.
WORLD FOOD SITUATION 1946-47. (Confidential.) 1946.
50. U. S. Department of Agriculture, Office of Foreign Agricultural Relations.
FOREIGN AGRICULTURE. Monthly magazine.
51. Kuniholm, Bertel E., Chargé d'Affaires a.i. Rīga, Latvia.
MEMORANDUM ON SOVIET FOOD INDUSTRY. REPORT No. 337. U. S. Department of State. May 20, 1939.
52. U. S. Embassy in Moscow.
REPORTS of the U. S. Embassy in Moscow dealing with Soviet Agriculture and the Food Situation.
53. Volin, Lazar.
AGRARIAN COLLECTIVISM IN THE SOVIET UNION, Journal of Political Economy, vol. XLV, no. 5, October 1937, and no. 6, December 1937.

B. Principal sources for Topics 93, 94, and 95

(1) Evaluation for Topics 93, 94, and 95

Available Russian source data for general geology and geography are, as a rule, more reliable and of more recent

date than are data for economic resources. During World War II very little information on timber and mineral resources was released by the Soviet Government. Since the end of the war, even less official information has been released. Official Russian publications, however, are practically the only original sources of recent information available. Some data have been obtained from captured German documents, but much of this information was compiled from official Russian sources. An understanding of Russian terms and methods of estimating reserves, as explained in Topic 95, indicates that the official reports may be less exaggerated than they at first appear. Total reserve figures commonly include estimates of potential resources, based only on geologic prognosis, together with estimates of known reserves. Capacities and productions estimated in advance for the various five-year plans (and in many cases not realized) are commonly included along with known production of existing plants and mines. However, the distinction between actual and planned or estimated data is generally clear. Production data for minerals, especially fuels, are incomplete for much of the recently annexed territory on the western border.

References found to be particularly useful are: for Water Resources, 2, 3, 7, 43, 45, 51, and 52; for Construction Materials, 3, 18, 45, and 47; for Mineral Resources, 18, 31, 35, 42, 46, and 50.

(2) List of references

(a) Water resources

1. Baltische hydrologische und hydrometrische Konferenz, II (second Baltic Hydrologic and Hydrometric Conference). Papers (mostly in German, some in French). Tallinn. June 1928.
2. Davydov, L. K. (general ed.).
   Spravochnik po Vodnym Resursam SSSR (Handbook of Water Resources of USSR). Tsentral'noe Upravlenie Edinoy Gidro-meteorologischeskoi Sluzhby Soyuza SSR Gosudarstvenny, Gidrologicheskiy Institut. Tom 8 (Middle Volga Region); Tom 10 (Northern Caucasus). Leningrad. 1936.
3. Generalstab des Heeres, Abteilung für Kriegskarten und Vermessungswesen.
   Militargeographische Angaben über das europäische Russland (Military Geography Manuals on European Russia). Berlin. 1941-1942.
   - A. Allgemeiner Überblick (General Summary)
   - B. Gebiet Leningrad (Leningrad Region)
   - D. Karelien und Kola (Karelia and Kola Region)
   - F. Ukraine (Ukraine Region)
   - J. Kaukasien (Caucasus)
   - K. Die Wolgagebiete (Volga Region)
   - M. Gebiete Wologda-Arkhangel'sk (Wologda-Archangel Region)
   - N. Nordost-Russland (Northeastern European Russia)
4. Generalstab des Heeres, 9. Abteilung.
   Kartenbeilagen zur militargeographischen Beschreitbung von Polen (Map Appendix to the Military-Geographical Description of Poland). Berlin. 1939.
5. Gidrogeologicheskiy Ocherk Donetskogo Basseyna (Hydrogeologic Description of the Donetz Basin). Institut Podzemnykh Vod, Glavnoe Geologo-Razvedochnoe Upravlenie. In Russian; English summary pp. 285-292. Moscow and Leningrad. 1940.
6. Hydrologische Konferenz der baltischen Staaten, V (Fifth Hydrologic Conference for the Baltic States). Reports and Communications. Tallinn. June 1936.
7. Imbeaux, E.
   Essai d'Hydrogeologie (Treatise on Hydrogeology). Pp. 223-229. Paris. 1930.
8. Makov, K. I.
   On a Comparative Evaluation of the Water Content of Aquifers. Comptes rendus (Doklady) de l'Academie des Sciences de l'U.R.S.S., Nouvelle série, vol. 43, no. 3, pp. 112-115 (in English). Moscow. 1944.
9. Trudy Pervogo Vsesoyuznogo Gidrologicheskogo S'ezda (Proceedings of the First Hydrological Congress of USSR). Komitet Vsesoyyznykh Gidrologicheskikh S'ezdov. Leningrad, Izdanie Gosudarstvennogo Gidrologicheskogo Instituta. 1925.
10. Trudy Vtorogo Vsesoyuznogo Gidrologicheskogo S'ezda (Proceedings of the Second Hydrological Congress of USSR) Chast' 2. Komitet Vsesoyyznkh Gidrologicheskikh S'ezdov. Leningrad, Izdanie Gosudarstvennogo Gidrologicheskogo Instituta. 1929.
11. Vasilevskiy, M. M.
    Skhema osnovnogo gidrogeclogicheskogo rayonirovaniya Evropeyskoy chasti SSR: (A Scheme of Hydrogeological Provinces for the European Part of USSR). Sovetskaya Geologiya, Tom 8, nos. 8-9, pp. 9-18. 1938.
12. U. S. War Department, Office of Chief of Engineers, M.I.D.
    Permafrost or Permanently Frozen Ground and Related Engineering Problems. Special Report, S.E.S. No. 62. 231 pp., illus. (Second printing with corrections). August 1945.
13. Zhukov, V. A., Tolstoi, M. P., and Troyanskiy, S. V.
    Artezianskie vody Kamennougol'nykh otlozheniy Podmoskovnoy Paleozoyskoy Kotloviny (Artesian waters of the carboniferous deposits of the Paleozoic of the Moscow Basin). Trudy Vsesoyuznogo Nauchno-issledovatel'skogo Instituta Mineral'nogo Syrya. Vyp. 153. Moscow and Leningrad. 1939.

(b) Construction materials

14. Almeida, P. Camena D'.
    Geographie Universelle: Tome 5, Etats de la Baltique Russie (World Geography: Vol. 5, States of Baltic Russia). Paris, p. Vidal de la Blache et L. Gallois. 1932.
15. Bubnoff, S. Von.
    Geologie der Erde: Band 1, Geologie von Europa (Geology of the Earth: Vol. 1, Geology of Europe). Berlin. 1926.
16. Gregory, J. S. and Shave, W. D.
    The USSR, a geographical study. London. 1944.
17. Handbook of the Soviet Union. American-Russian Chamber of Commerce. New York. 1936.
18. Guidebooks for the Excursions; English edition. International Geological Congress, 17th. Moscow and Leningrad. 1937.
    - The Northern Excursion:
      - (Vol. 1) Karelian ASSR
      - (Vol. 2) Kola Peninsula
    - The Southern Excursion:
      - (Vol. 3) Donetz Coal Basin (Donbass)
      - (Vol. 4) Ukrainian SSR
      - (Vol. 5) Crimean ASSR
    - Excursion to the Moscow Coal Basin:
      - (Vol. 25) Moscow Coal Basin
19. Korisni Kopalini Ukraini, Zbirnik (Useful Rocks and Minerals of the Ukraine). 204 pp., illus. Vidavnitstvo Vseukrains'koi Akademii Nauk, Institut Geologii. Kiev. 1934.
20. Muller, G., and Jureviz, J.
    Structurbericht über das Ostland (Report on Structure in the Orient). Ostaland-Atlas, Teil 2, Reichskommissar fur das Ostland, Abt. 2. Rīga. 1942.
21. Roumanie, Ministère de l'Industrie et du Commerce.
    Correspondence Économique Roumaine, bull. officiel, vol. 6, no. 4. Bucharest. 1924.
22. Sotsialisticheskoye Strcitel'stvo SSSR. (Socialistic Structure of the USSR). Statisticheski Ezhegodnik, Tsentral'noe Upravlenie Narodnokhozanistvennogo Ucheta. Moscow. 1935.
23. Zon, R., and Sparhawk, W. N.
    Forest Resources of the World. Vol. 1. New York. 1923.

See also references 3 and 4

(c) Mineral resources

24. Anderson, R. J.
    Russian Aluminum. The Mining Magazine, vol. 58, pp. 73-86. London. 1938.
25. Bohdanowicz, C.
    Natural Gas Occurrences in Russia (USSR). Am. Assoc. Petroleum Geologists Bull., vol. 18, pp. 746-759. 1934.
26. ———
    Oil Fields of Poland, Geological and Statistical Summary. Am. Assoc. Petroleum Geologists Bull., vol. 17, pp. 1084-1097. 1933.

27. Edwards, T.
THE MINERAL DEPOSITS OF THE USSR. The Mining Magazine, vol. 58, pp. 265-279 and 335-343. London. 1938.

28. Ekis, L.
LATVIA, ECONOMIC RESOURCES AND CAPACITIES. Press Bureau of the Latvian Legation. Washington. 1943.

29. ENERGETICHESKIE RESURSY SSSR (Energy Resources of the USSR). Tom 1. Akademiya Nauk SSSR., Energeticheskiy Institut. 1937.

30. Fox, C. S.
MINERAL DEVELOPMENT IN SOVIET RUSSIA. Mining, Geological, and Metallurgical Institute of India Transactions, vol. 34, pp. 98-201. 1938.

31. Gubkin, I. M. (general ed.).
GEOLOGICHESKAYA IZUCHENOST I MINERALNO-SYRIEVAYA BAZA SSSR K 18 SYEZDY VKP (B) (Geological Investigation and Mineral Resources of USSR, compiled for the 18th Session of VKP). Moscow and Leningrad. 1939.

32. Metallgesellschaft A. G.
RESOURCES OF THE USSR IN RAW MATERIALS. Economic Division, Memorandum. Frankfurt. (Translation of captured document. 1941.

33. Öpik, A.
LES RÉSERVES MONDIALES EN PHOSPHATE: GISEMENTS PHOSPHATES EN ESTHONIE (World Reserves of Phosphate: Phosphate Deposits in Estonia). International Geological Congress, 14th, Spain, 1926. Pp. 135-194. Madrid. 1928.

34. Prigorovsky, M. M.
THE COAL RESOURCES OF THE USSR. International Geological Congress, 17th. Moscow. 1937.

35. Reichstelle Für Bodenforschung.
DIE WICHTIGSTEN LAGERSTÄTTEN DER ERDES HEFT 3, DIE BODENSCHÄTZE DES EUROPÄISCHEN RUSSLANDS (OHNE ERDÖL); HEFT 4, ERDÖL IN RUSSLAND (The Chief Mineral Deposits of the World: Vol. 3, The Natural Resources of European Russian (excluding petroleum); vol. 4, Petroleum in Russia). Illus. Berlin. 1941. (captured)

36. République, Polonaise, Office Central de Statistique.
LA REPUBLIQUE POLONAISE, ATLAS STATISTIQUE (Polish Republic, Statistical Atlas). Warsaw. 1930.

37. Tolwinski, K.
LES EXPLOITATIONS DE PETROLE ET DE GAS NATURAL EN POLOGNE EN 1933-1936 (Exploitation of Petroleum and Natural Gas in Poland in 1933-1936). World Petroleum Congress, 11th. Vol. 1, pp. 81-100. Paris. 1937.

38. ———
NATURAL GAS IN POLAND. Am. Assoc. Petroleum Geologists Bull., vol. 18, pp. 892-907. 1934.

39. Tyrrell, G. W.
THE DEVELOPMENT OF MINERAL RESOURCES IN THE SOVIET UNION. SCIENCE IN SOVIET RUSSIA, edited by J. Needham and J. S. Davies. London. 1942.

40. ———
A GEOLOGIST IN THE SOVIET UNION. Proc. Royal Phil. Soc., vol. 67, pp. 41-52. Glasgow. 1942.

41. U. S. Department of the Interior, Bureau of Mines.
MINERAL PRODUCTION AND TRADE OF USSR (Russia). Foreign Minerals Quarterly, vol. 1, no. 2, section 2. June 1938.

42. ———
FOREIGN MINERALS SURVEY, vol. 1, no. 8. 1944.
See also references 17 and 18.

(d) Maps and charts for Topics 93, 94, and 95

43. BOL'SHOI SOVETSKIY ATLAS MIRA: I, II (Great Soviet World Atlas: Volumes 1 and 2). Tsentralniy Komitet: Soviet Narodnykh Komissarov Soyuza SSR. Moscow. 1937 (Vol. 1), 1939 (Vol. 2). English Key to Vol. 1 by G. B. Cressey and others, Syracuse University, N. Y. 1941.

44. GEOLOGICHESKAYA KARTA SSSR. (Geologic Map of USSR). International Geological Congress, 17th. Scale 1:5,000,000. (In Russian, with English legend) Moscow and Leningrad. 1937.

45. GEOLOGICHESKAYA KARTA SSSR. (Geologic Maps of USSR). Komitet po Delam Geologii pri shk SSSR. Series of 1:1,000,000 scale. Moscow. 1939 ——.

46. KARTA POLEZNYKH ISKOPAEMYKH (Maps of Useful Minerals).
KAREL'SKOY ASSR (Karelian ASSR). Scale 1:1,500,000. 1930.
TSENTRAL'NOGO RAYONA (Central District). Scale 1:750,000. 1930.
LENINGRADSKOY OBLAST' (Leningrad Oblast). Scale 1:1,500,000. 1930.
DONBASSA I KRIVOGO ROGA (Donetz Basin and Krivoy Rog). Scale 1:1,500,000. 1930.

47. MAP OF ROAD-BUILDING MATERIALS IN THE EUROPEAN PART OF USSR. Central Scientific Research Institute of Highways and Road Building Machinery (Zdornii). Scale 1:1,500,000. Legend material in English and Russian. Leningrad and Moscow. 1935.

48. OBZORNAYA KARTA POLEZNYKH ISKOPAEMYKH EVROPEYSKOY CHASTI SSSR (General Map of Useful Minerals in the European Part of USSR). Scale 1:7,000,000. 1930.

49. Service Géologique de Pologne.
CARTE DES RESSOURCES MINÉRALES DE LA RÉPUBLIQUE POLONAISE (Map of Mineral Resources of the Polish Republic). Scale 1:750,000. Warsaw. 1931.

50. UNION DER SOZIALISTISCHEN SOWJETREPUBLIKEN, EUROPÄISCHER TEIL, ROHSTOFFWIRTSCHAFT. (USSR, European Part, Natural Materials Resources.) Karte (map) Va, Okw Wi Rü Amt/Wi. Scale 1:4,000,000. 1941. (Captured.)

51. U. S. Army Map Service.
WORLD TOPOGRAPHIC 1:1,000,000 SERIES (COVERING EUROPEAN RUSSIA). 1941 ———.

52. Yakovlev, S. and others.
MAP OF QUATERNARY DEPOSITS OF THE EUROPEAN PART OF THE USSR AND THE ADJACENT REGIONS. Central Scientific Geological and Research Institute, Geological and Prospecting Service. Scale 1:2,500,000. 6 sheets. Title and legend in English and Russian; place names in Russian. 1932.
See also references 3, 4, 20, and 36.

C. Principal sources for Topic 96

(1) Evaluation for Topic 96

Available sources of information on electric power during World War II and later dates are limited. Production statistics for the electric power industry have not been very clear since 1936. The Soviet losses in generating equipment during the war amounted to approximately 50% of the total installed capacity. Recent reliable source material states that the industry recovered very rapidly, and in 1945 the installed capacity nearly equaled the prewar level.

Captured German documents supplied general information on electric power development in European USSR, and the operation of the industry in the Baltic States during the occupancy by the Germans themselves (1941-1944). In certain instances the reliability of the data is questionable.

Information on developments in the Baltic States in 1945 was limited due to the censorship imposed by the Soviet authorities. No foreign correspondents were admitted to those parts. Most of the news concerning the Baltic countries dealt with international status rather than with internal events and referred to them as a group rather than as individual states. Pertinent comments on the outstanding sources follow:

Sources 1, 9, 10, 11, 21, 24, 35, 36, and 39 are publications and reports containing text and excellent statistics on hydroelectric development, resources, and projects.

Sources 2, 15, 18, 19, and 20 contain valuable information on the construction, reconstruction and progress of specific power plants, and the rehabilitation of the electric power industry in areas of European USSR.

Source 3 is a reliable document and a valuable source of good data for the Murmansk area.

Sources 12, 13, 14, and 40, captured German material, including the Military-Geography reports, maps, books of photographs, and text material, furnished good general and specific power plant data. In several instances the statistics conflicted with other intelligence reports from different sources.

Sources 25, 26, 27, 28, 29, and 30 furnished excellent material on electric power development and plant capacities for the Baltic States up to 1939.

Source 37, a technical publication, contained valuable information on the electric power development in the USSR up to 1936.

(2) List of references

(a) Documents

1. THE CURRENT PROGRESS OF THE KUYBYSHEV POWER STATION. Russian Economic Notes, new series, vol. 2, no. 9, pp. 6-8. 15 May 1940.
2. ELECTRIC POWER PLANT. Moscow News. P. 1. 10 July 1946. (Restricted.)
3. ELECTRICITY SUPPLIES IN NORTH CAPE AND MURMANSK AREA. Army Map Service Document no. 3435. 6 pp., illus. 7 Jan. 1942. (Confidential.)
4. ELEKTRICHESKIYE STANSTII (Electric Stations). No. 1. Moskva. 1946.
5. ———
   No. 3. Moskva. 1946.
6. ———
   No. 10. Moskva. 1945.
7. ENCYCLOPEDIA BRITANNICA. Chicago. 1945.
8. ENERGETICHESKOYE KHOZYAYSTVO (Power Economy). Gosplan SSSR (Government Planning Agency, Power Economy). Moscow. 1931.
9. GIDROTEKHNICHOSKOYE STROITEL'STVO (Hydrotechnical Construction). No. 4, 1946.
10. L'IMPIANTO IDROELETTRICHO DEL SVIR INFERIORE (The Hydroelectric Plant of the Lower Svir). L'Energia Elettrica. Nov. 1937.
11. DER KUJBYSCHEWSKER WASSERKRAFTGIGANT (The Kuybyshev Giant Hydraulic Power Plant). Zeitschrift für Binnenschiffahrt. Nos. 1 and 2. 1940.
12. KURZER ZUSAMMENFASSENDER BERICHT ÜBER DIE AUFGABESTELLUNG UND DIE SCHLUSSABWICKLUNG DER ENERGIEVERSORGUNG OSTLANDS (Short Compiled Report on the Problems and Final Development of the Power Supply in the Baltic Countries). German Army General Staff, group 44. Berlin. 1944.
13. MILITÄRGEOGRAPHISCHE ANGABEN ÜBER DAS EUROPÄISCHE RUSSLAND (Military Geographical data on European Russia — A to M). German Army General Staff. Berlin. 1941.
14. MILITÄRGEOGRAPHISCHE BESCHREIBUNG VON LITAUEN UND DEM MEMELGEBIET (Military Geographical Description of Lithuania and Memel District). German Army General Staff, Group 41. Berlin. 1939.
15. MORE ELECTRIC POWER FOR THE UKRAINE. Trud, p. 2. 15 Oct. 1946. (Restricted.)
16. Office of Strategic Services.
    BASIC INDUSTRIES IN THE USSR. R and A no. 2060.2. 6 July 1945.
17. PRODUCTION OF THE MOSKVA OBLAST' UNDER THE FIVE-YEAR PLAN. Tarasvo, P. S., p. 2, Izvestiya. 22 June 1946.
18. RESTORATION OF POWER PLANTS. Pravda, p. 1. 31 Aug. 1946. (Restricted.)
19. RURAL ELECTRIFICATION. Red Star, p. 1. 27 Oct. 1946. (Restricted.)
20. SOVIET ELECTRIC POWER INCREASES. Borisov, S. Information Bulletin, vol. 6. pp. 3-5, illus. Embassy of the USSR. 16 Oct. 1946.
21. SPRAVOCHNIK PO VODNYM RESURSAM SSSR (Guide to the Water Resources of the USSR). Shakov. Set of 6 books.
22. TWENTY YEARS OF SOVIET ELECTRICAL GROWTH. Russian Economic Notes, new series, vol. 2, no. 8, pp. 1-3. 30 Apr. 1940.
23. U. S. Department of Commerce, Bureau of Foreign and Domestic Commerce.
    CENTRAL LIGHT AND POWER PLANTS IN SOVIET RUSSIA. No. 596. 18 July 1932.
24. U. S. Department of State.
    AN INTERVIEW WITH MR. RAYFIELD ON RECONSTRUCTION OF THE DNIEPER DAM. Report no. 43, 4 pp. Moskva: American Embassy. 17 Mar. 1947. (Confidential.)
25. ———
    ESTONIA. Report no. 29. American Consulate. 26 Feb. 1938.
26. ———
    ESTONIA. Report no. 131. American Consulate. 24 Nov. 1939.
27. ———
    ESTONIA. Report no. 377. American Consulate. 14 Dec. 1936.
28. ———
    LATVIA. Report no. 23. American Consulate. 20 Mar. 1935.
29. ———
    LITHUANIA. Report no. 168. American Consulate. 14 Dec. 1938.
30. ———
    LITHUANIA. Report no. 173. American Consulate. 6 Nov. 1937.
31. U. S. Department of State, Office of Intelligence Research.
    REQUIREMENTS AND SUPPLY OF FUELS AND POWER IN THE USSR, 1946-1950. Report no. 4322, 99 pp. 1 May 1947. (Confidential.)
32. U. S. Navy Department, Office of Naval Intelligence.
    RUSSIA. INDUSTRY AND INDUSTRIAL RESOURCES. Serial no. F1-4, 3 pp. 24 Mar. 1943.
33. ———
    BRIEF REPORT ON ELECTRIC POWER PLANTS. Serial no. 62-45. 1 p. 3 Apr. 1945. (Confidential.)
34. U. S. War Department, Army Service Forces.
    ASF MANUAL M356-10A, CIVIL AFFAIRS HANDBOOK — GERMANY — ELECTRIC POWER. Feb. 1944.
35. U. S. War Department, General Headquarters, Far East Command, Military Intelligence Section.
    DNIEPER HYDROELECTRIC POWER STATION RESTORATION. 1 p. 8 July 1947. (Confidential.)
36. U. S. War Department, Military Intelligence Division.
    DNIEPER POWER DEVELOPMENT IN USSR. MA Report no. 8887. AMS document no. 1479-C. 7 pp. 13 May 1943. (Confidential.)
37. DIE WEHRWIRTSCHAFT DER UdSSR (Military Economy of the USSR). Berlin. 1941.
38. Weitz, Benjamin I.
    ELECTRIC POWER DEVELOPMENT IN THE USSR. Moscow: Inra Publishing Society. 1936.
39. Wilkinson, Henry B.
    DNIEPROSTROI (The Dnieper River Project). Military Engineer. Pp. 123-140, illus. Mar.-Apr. 1933.

(b) Maps

40. KARTENBEILAGEN ZUR MILITÄRGEOGRAPHISCHEN BESCHREIBUNG. . . . (Map Supplements to the Military Geographical Description of. . . .) (covering series of areas in Russia, Poland, Baltic countries, Finland). German Army General Staff. Berlin. 1939-41.
41. POLITIKO-ADMINISTRATIVNAYA KARTA YEVROPEYSKOY CHASTI SSSR (Political-Administrative Map of the European Part of USSR). Scale 1:2,000,000. Published by Glavnoye Upravleniye Geodesii i Kartografii pri Sovete Ministrov SSR. About 1946.
42. MAP OF THE EUROPEAN PART OF USSR. Scale 1:1,500,000. Originally published by the People's Commissariat of USSR, Chief Administration of the State Geodetic Survey and Cartography. Reprinted by Army Map Service, U. S. Army, Washington, D. C., 108534, 1943.
43. TOPOGRAFICHESKAYA KARTA SSSR (Topographic Map of the USSR). Scale 1:1,000,000, 1:500,000, 1:100,000, 1:50,000. Series published by General'ny Shtab Krasnoy Armii (General Staff of the Red Army). Mostly 1941, some 1925-42.
44. KARTE DES EUROPÄISCHEN RUSSLAND 1:300,000, VORLÄUFIGE AUSGABE (Map of European Russia, 1:300,000, Provisional Edition). (Enlarged reprint of Russian map 1:420,000 (10-verst map), corrected to 1921, with overprinting and transliterations). Partial set only. Germany, Reichsamt für Landesaufnahme. 1939.

D. Principal sources for Topic 97

(1) Evaluation of sources for Topic 97

Data used in the preparation of Topic 97 were furnished by United States government agencies, including the Federal Reserve Board, the Department of State, the Department of Interior, the Office of Strategic Services, and the intelligence services of the Departments of the Army and the Navy. Other sources of information were Soviet publications, interviews with specialists, and German documents. Data were checked with related information wherever this was possible. Additional references are listed in (2).

(2) List of references

1. Basic Law of the Fourth Five-Year Plan, 18 March, 1946.
2. Baykov, Alexander.
   Soviet Foreign Trade. Princeton University Press. 1946.
3. British Handbook on Russian Railways. 1940
4. Economic notes and bulletins of the American-Russian Chamber of Commerce. New York.
5. Oil Weekly, Annual Supplement. May 1946.

DESCRIPTION OF SURFACE-WATER REGIONS

1. LAKE REGION. Close net of perennial streams, numerous lakes.

Perennial streams or lakes commonly less than a mile apart. Lakes commonly occupy 20% to more than 50% of land area, and are important as regulators of stream flow.

2. HUMID REGION. Close net of perennial streams, but few lakes.

Perennial streams usually less than a mile apart; even small brooks commonly are perennial. Only widely scattered small lakes on marshy lowlands of main rivers.

3. PRIPET MARSH. Numerous perennial streams, but water is commonly of poor quality.

Extensive marshy region with many sluggish streams, a few small lakes. Mostly flooded in spring; water gradually drains away in summer. Organic contamination causes obnoxious taste and odor in water of many streams, especially in late summer.

4. TRANSITION ZONE. Local water shortages during summer droughts.

Near the northern margin of the zone, perennial streams commonly are less than 3 miles apart. Climate becomes drier and summer droughts more severe southward; near the southern margin, perennial streams generally are 5 miles or more apart. Practically no lakes.

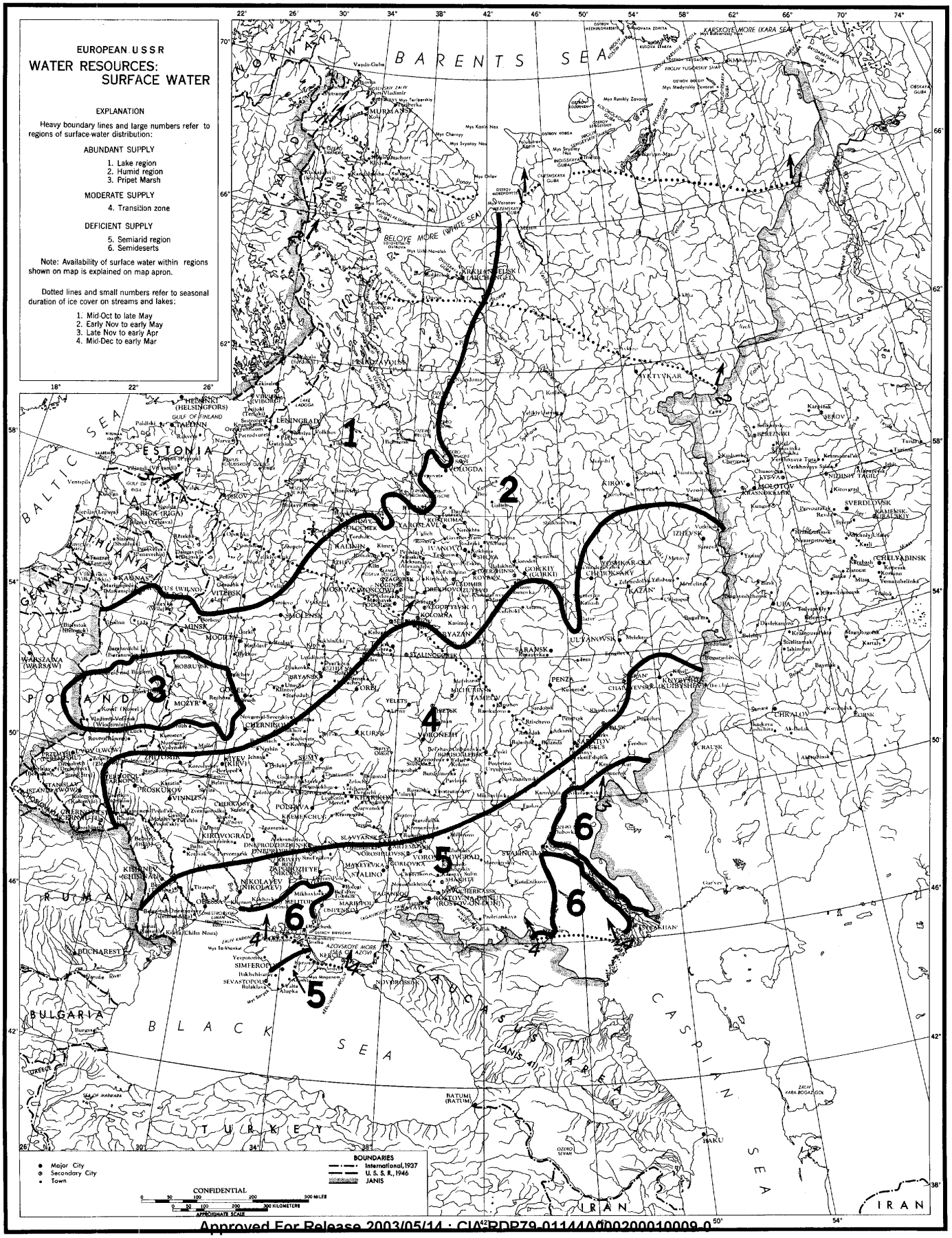
5. SEMIARID REGION. Perennial streams generally widely spaced; few lakes.

Perennial streams commonly 5 to 10 miles apart in north, decrease in abundance southward; as much as 20 miles apart near southern margin, where majority of streams are dry in August and September.

6. SEMIDESERTS. Intermittent streams only.

Streams flow for short periods after heavy rains. The few lakes and temporary ponds generally are saline.

FIGURE IX-53
WATER RESOURCES: SURFACE WATER
JANIS 40
~~CONFIDENTIAL~~



DESCRIPTION OF WATER-BEARING SURFICIAL SEDIMENTS

Map Unit 1. ALLUVIUM OF RIVER LOWLANDS.

Irregularly interstratified mixtures of sand, gravel, silt, and clay in varying proportions, underlying river lowlands to depths of 10 to 100 feet. In most places the alluvium contains moderately to highly productive aquifers; locally the alluvium is mostly clay, and aquifers are sparse. Most of the wells in European USSR are in river alluvium, but these wells generally are shallow, of low yield, and badly polluted. Springs are sparse to fairly numerous and generally small.

Map Unit 2. SANDY OR GRAVELLY UPLAND DEPOSITS.

Surficial deposits extensively mantling the bedrock outside the river lowlands. Depth to water is typically somewhat greater than in Map Unit 1; the thicker, less-dissected deposits are the most productive. Wells are fairly numerous in settled areas; most are shallow, polluted, and of small yield. Springs are sparse to numerous, and mostly small.

WATER RESOURCES: GROUND WATER FROM SURFICIAL SEDIMENTS

JANIS 40

~~CONFIDENTIAL~~

DESCRIPTION OF BEDROCK

Map Unit 1. WATER-BEARING POORLY CONSOLIDATED SEDIMENTS.

Deposits of poorly consolidated sediments distinguished from the thin surficial sediments (shown in map of ground water from surficial sediments) by their great thickness, 100 to several thousand feet. Fair to excellent water-bearing sands and gravels generally are present; these are lens-shaped and discontinuous, interbedded with much non-water-bearing clay and silt, and are very variable in distribution and depth. Water commonly is hard, otherwise of good chemical quality in most areas. Along seacoasts, however, and in parts of Crimea and lower Don-Volga regions, much or all ground water is intensely saline. Few wells in the very saline and far northern areas; elsewhere wells are numerous, shallow, and have small to large yield. Springs are rare except in hilly areas.

Map Unit 2. WATER-BEARING SEDIMENTARY ROCKS.

Interbedded hard shale, limestone, and sandstone. Generally fair to good aquifers are within 1,000 feet of surface, commonly between 100 and several hundred feet. Most aquifers are limestone, yield is small to large, ranging greatly within short distances; some sandstones give small to moderate yields. Deeper aquifers are commonly artesian, and in many areas wells of sufficient depth will flow at the surface. Strata are relatively persistent and in most places nearly horizontal. Water generally is hard, and in some districts some aquifers are saline. Numerous wells south of latitude 60° north have yields of a few to several hundred gallons per minute at depths ranging from 100 to more than 2,000 feet. Springs are common in many districts, but few yield more than 50 gallons per minute.

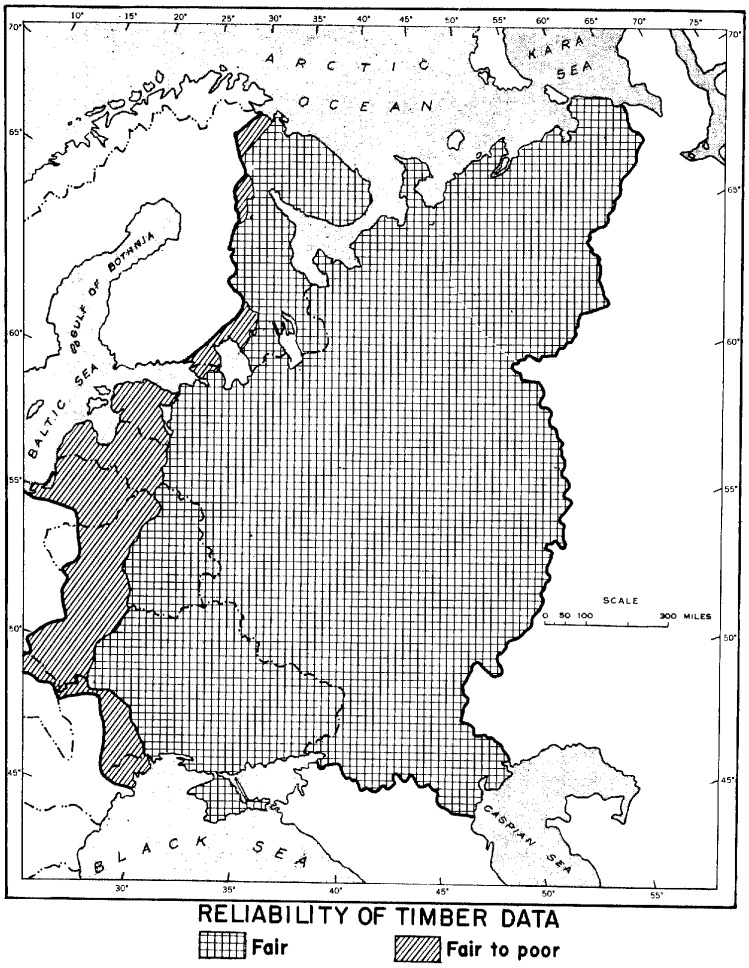
Map Unit 3. NON-WATER-BEARING SEDIMENTARY ROCKS.

Hard, generally impermeable sediments composed mainly of shale and dense sandstone and limestone to a depth of 1,000 feet or more, commonly underlain by water-bearing sediments at great depth. Wells are very few; practically all are deep drilled wells. Springs are rare and very small.

Map Unit 4. NON-WATER-BEARING CRYSTALLINE ROCKS.

Granite or schist, generally impermeable except along occasional fissures, which locally may yield small supplies. In northwest, numerous patches of sandy or gravelly surficial deposits, too small to be shown on map, will yield small supplies. In south, small yields can be obtained locally from top weathered zone, which generally is confined to uppermost 50 to 100 feet. In certain districts in the south, crystalline rocks crop out only in valleys, and in the intervening uplands they are covered by soft sandstone and gravel with several water-bearing zones; the lowest zone is continuous with the weathered zone in the granite. Wells are very few, except locally in overlying water-bearing sediments. Springs are rare in north, fairly common in many parts of south, but mostly small.

FIGURE IX-55
WATER RESOURCES: GROUND WATER FROM BEDROCK
JANIS 40
CONFIDENTIAL



Approved For Release 2003/05/14 : CIA-RDP79-01144A000200010009-0

FIGURE IX-56
CONSTRUCTION MATERIALS: TIMBER
JANIS 40
CONFIDENTIAL

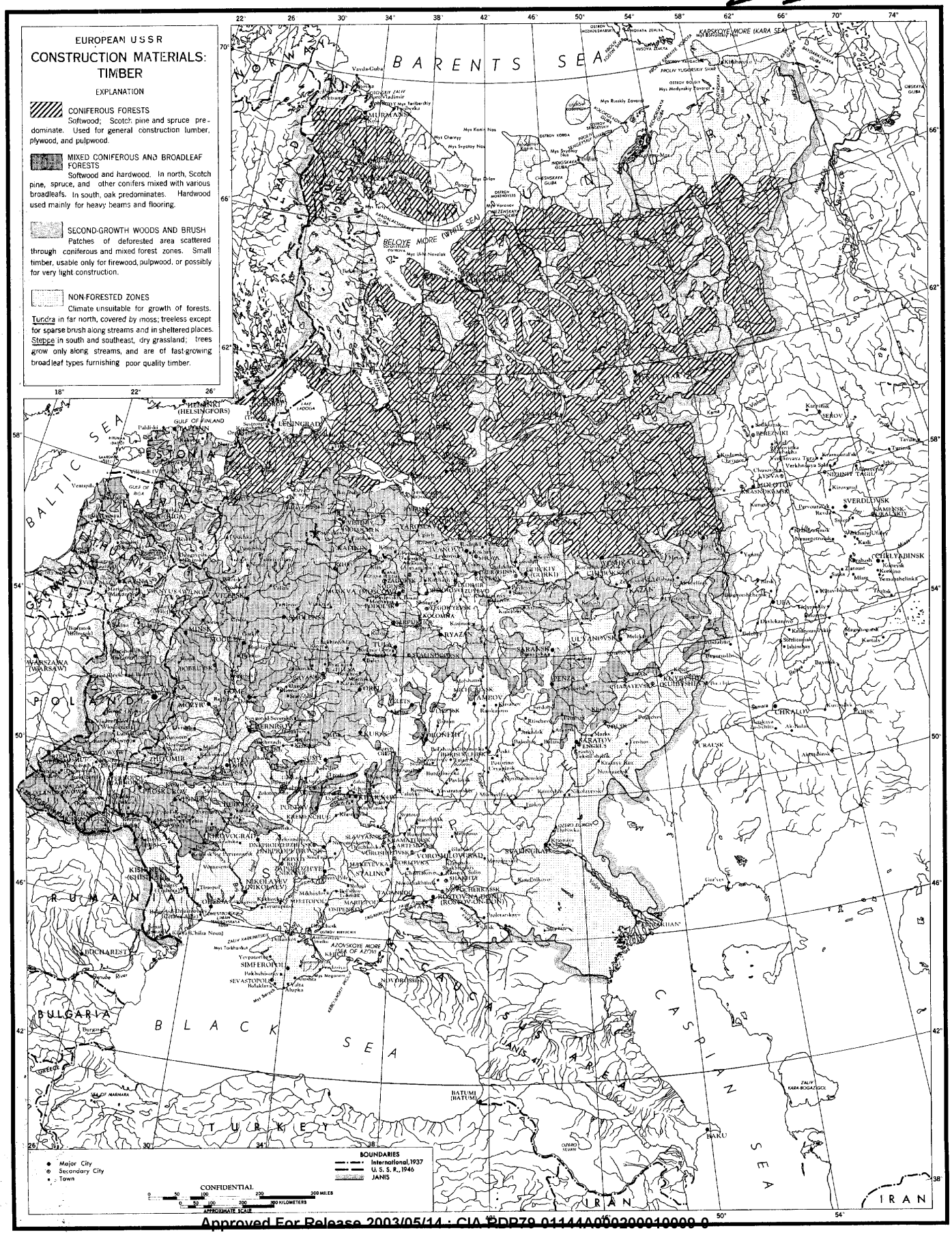
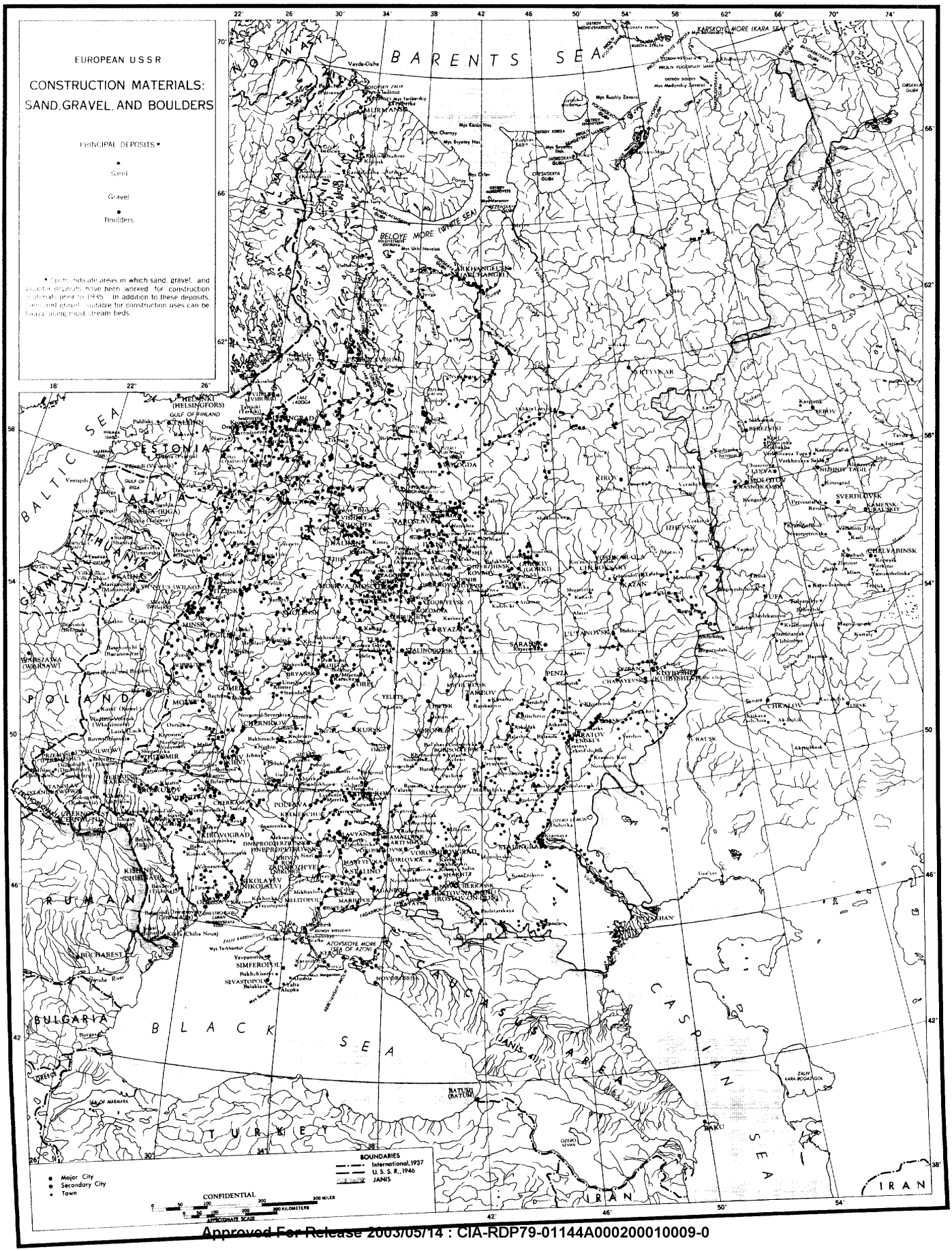
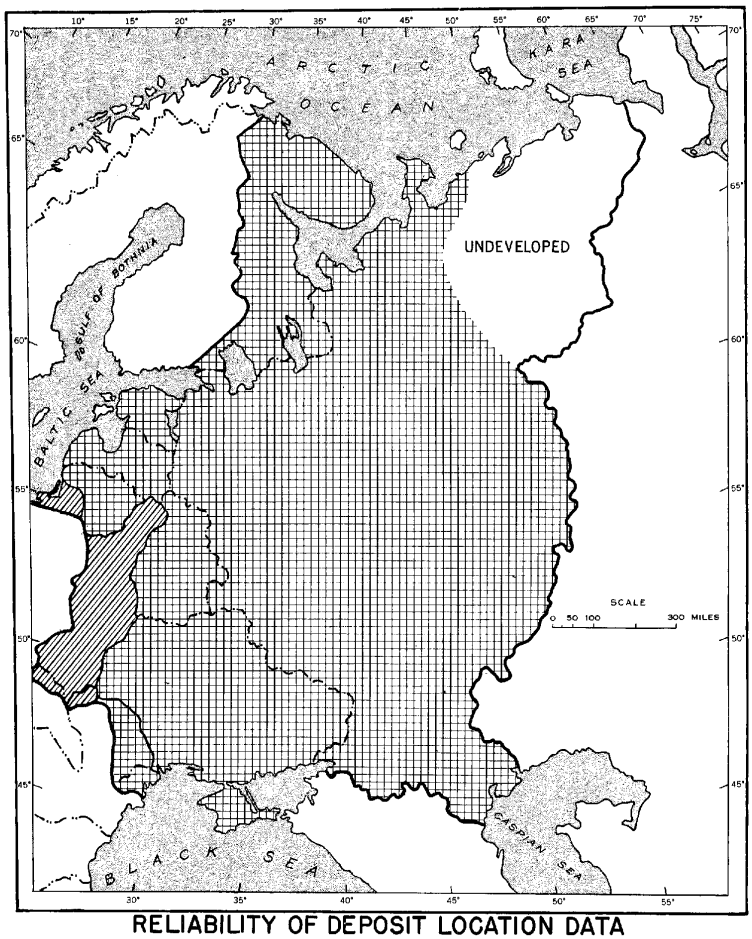


FIGURE IX-57
CONSTRUCTION MATERIALS: SAND, GRAVEL, AND BOULDERS
JANIS 40
CONFIDENTIAL





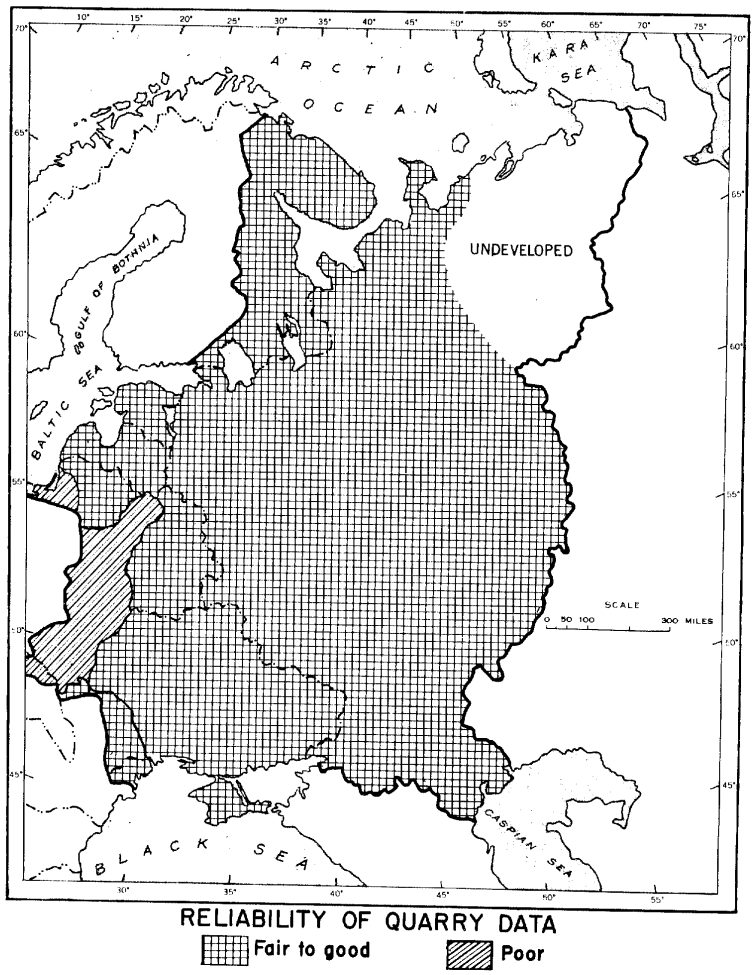


FIGURE IX-58
CONSTRUCTION MATERIALS: BEDROCK QUARRIES
JANIS 40
CONFIDENTIAL

FIGURE IX-59
MINERAL RESOURCES: METALS
JANIS 40
~~CONFIDENTIAL~~

FIGURE IX-60
MINERAL RESOURCES: NONMETALS
JANIS 40
~~CONFIDENTIAL~~

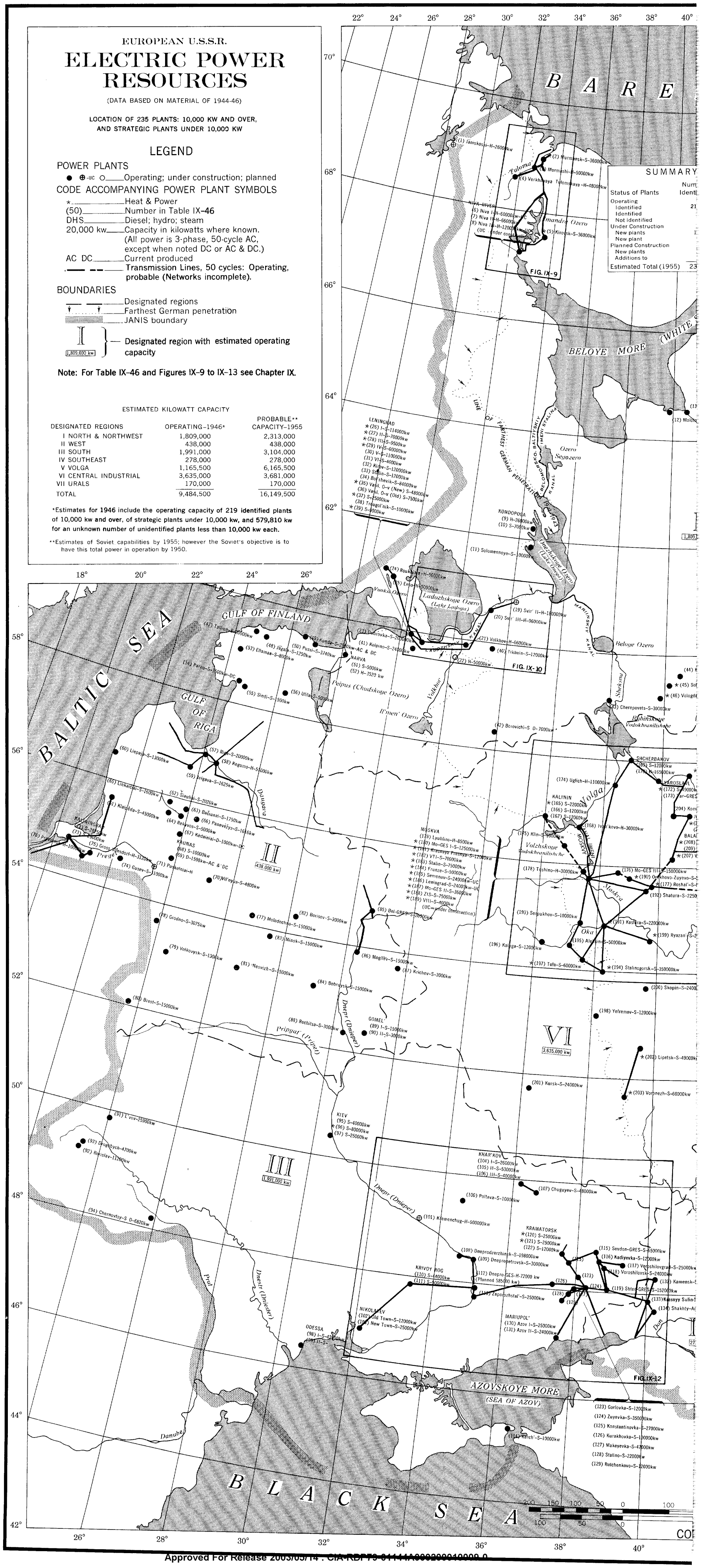
FIGURE IX-61
MINERAL RESOURCES: FUELS
JANIS 40
~~CONFIDENTIAL~~

EUROPEAN U.S.S.R.

ELECTRIC POWER RESOURCES

(DATA BASED ON MATERIAL OF 1944-46)

LOCATION OF 235 PLANTS: 10,000 KW AND OVER, AND STRATEGIC PLANTS UNDER 10,000 KW



LEGEND

POWER PLANTS

● ⊕-UC ○ Operating; under construction; planned

CODE ACCOMPANYING POWER PLANT SYMBOLS

- * — Heat & Power
- (50) — Number in Table IX-46
- DHS — Diesel; hydro; steam
- 20,000 kw — Capacity in kilowatts where known. (All power is 3-phase, 50-cycle AC, except when noted DC or AC & DC.)
- AC DC — Current produced
- — — — Transmission Lines, 50 cycles: Operating, probable (Networks incomplete).

BOUNDARIES

- Designated regions
- Farthest German penetration
- JANIS boundary
- I [1,809,000 kw] — Designated region with estimated operating capacity

Note: For Table IX-46 and Figures IX-9 to IX-13 see Chapter IX.

ESTIMATED KILOWATT CAPACITY

DESIGNATED REGIONS	OPERATING-1946*	PROBABLE** CAPACITY-1955
I NORTH & NORTHWEST	1,809,000	2,313,000
II WEST	438,000	438,000
III SOUTH	1,991,000	3,104,000
IV SOUTHEAST	278,000	278,000
V VOLGA	1,165,500	6,165,500
VI CENTRAL INDUSTRIAL	3,635,000	3,681,000
VII URALS	170,000	170,000
TOTAL	9,484,500	16,149,500

*Estimates for 1946 include the operating capacity of 219 identified plants of 10,000 kw and over, of strategic plants under 10,000 kw, and 579,810 kw for an unknown number of unidentified plants less than 10,000 kw each.

**Estimates of Soviet capabilities by 1955; however the Soviet's objective is to have this total power in operation by 1950.

FIGURE IX-62
POWER MAP OF EUROPEAN USSR
JANIS 40
~~CONFIDENTIAL~~

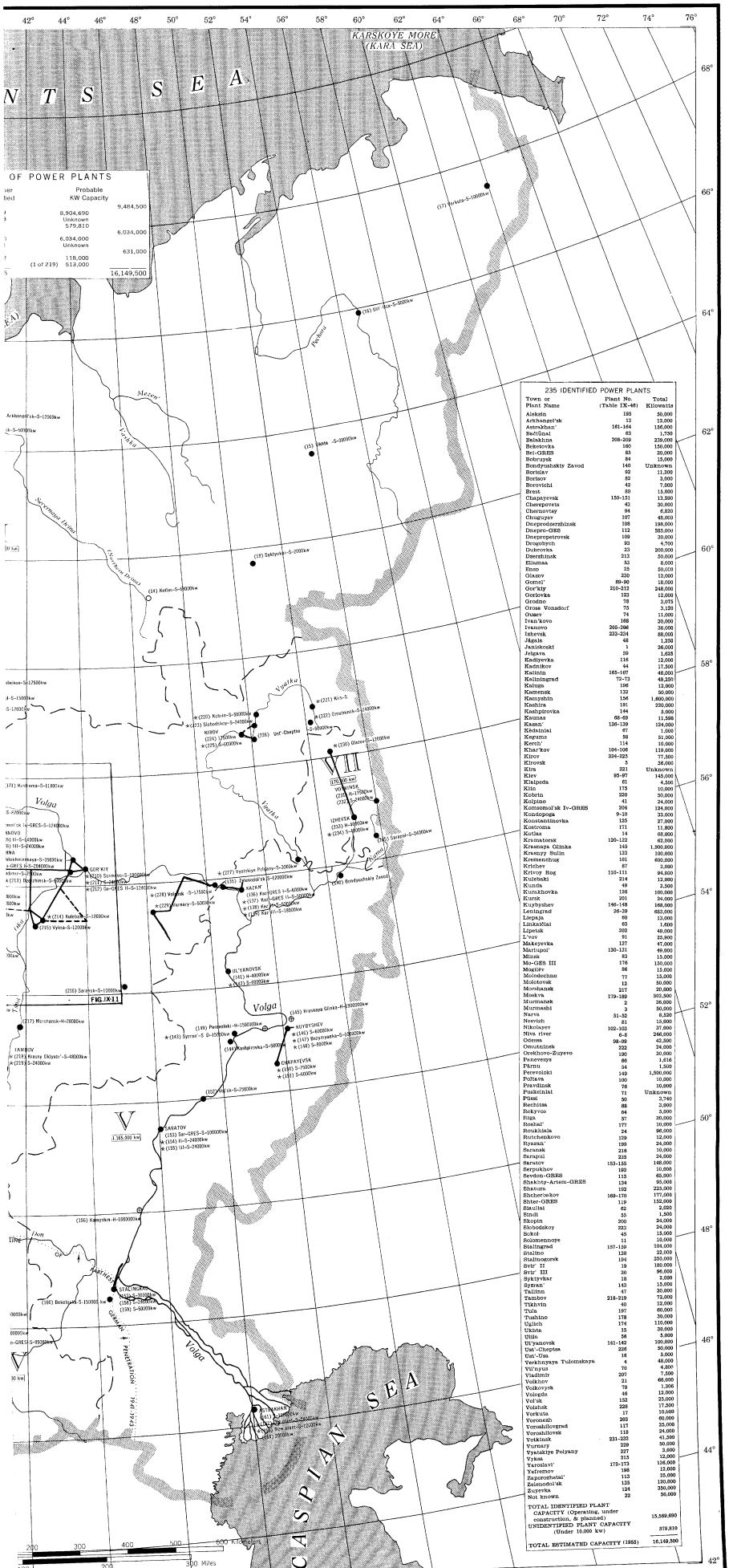


FIGURE IX-63
FERROUS METALLURGY
JANIS 40
~~CONFIDENTIAL~~

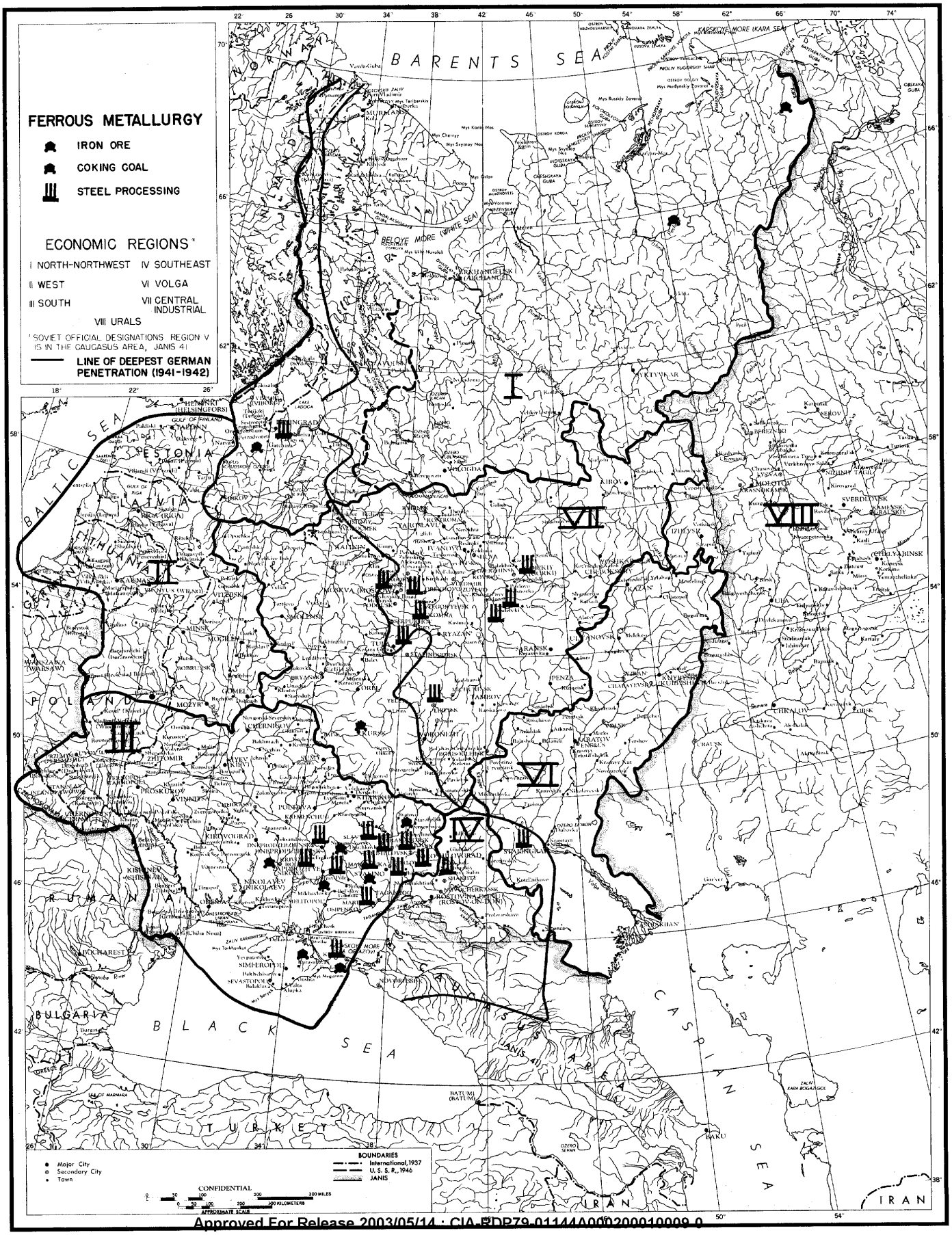


FIGURE IX-64
MACHINE BUILDING INDUSTRY
JANIS 40
~~CONFIDENTIAL~~

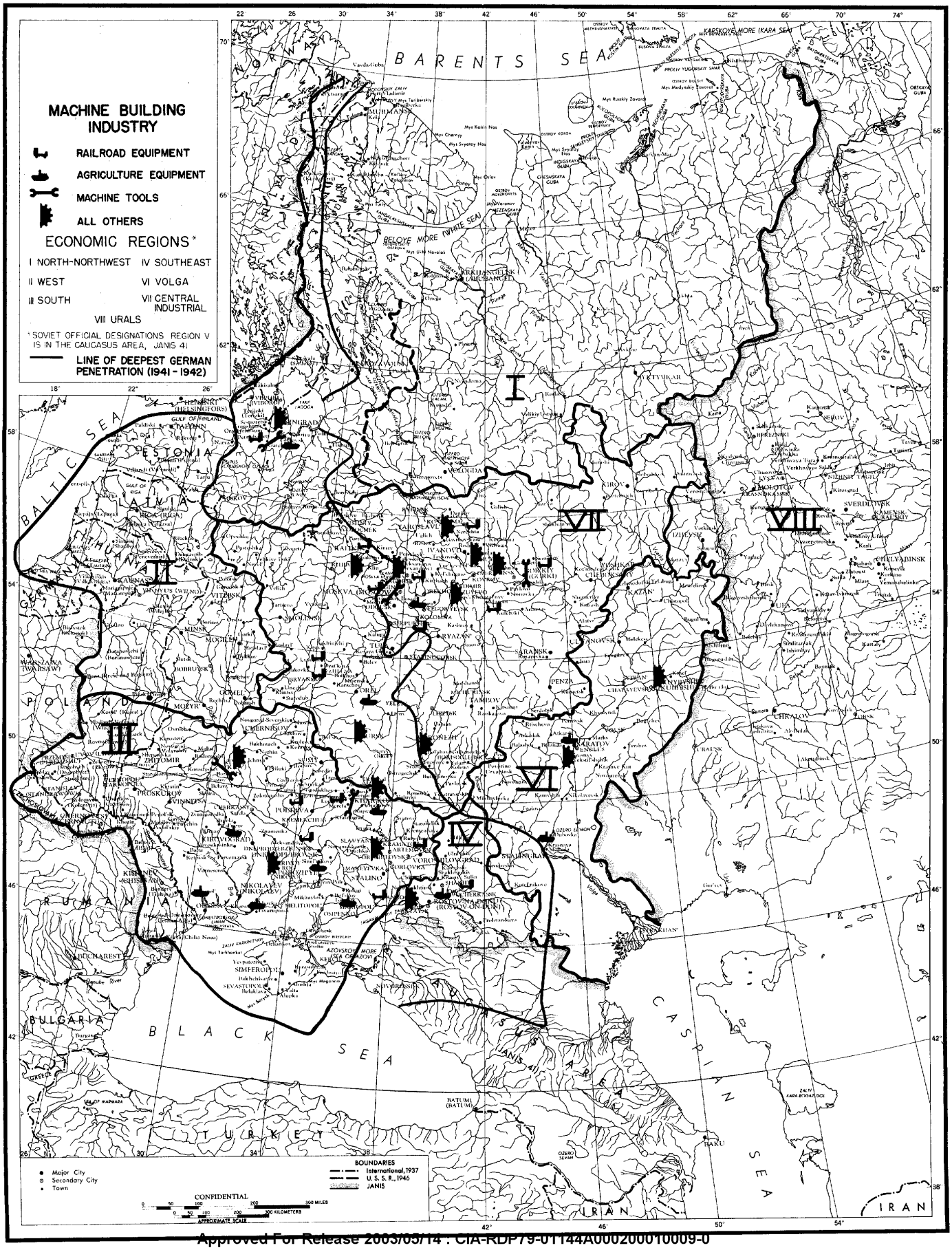


FIGURE IX-65
PETROLEUM AND CHEMICAL INDUSTRIES
JANIS 40
~~CONFIDENTIAL~~

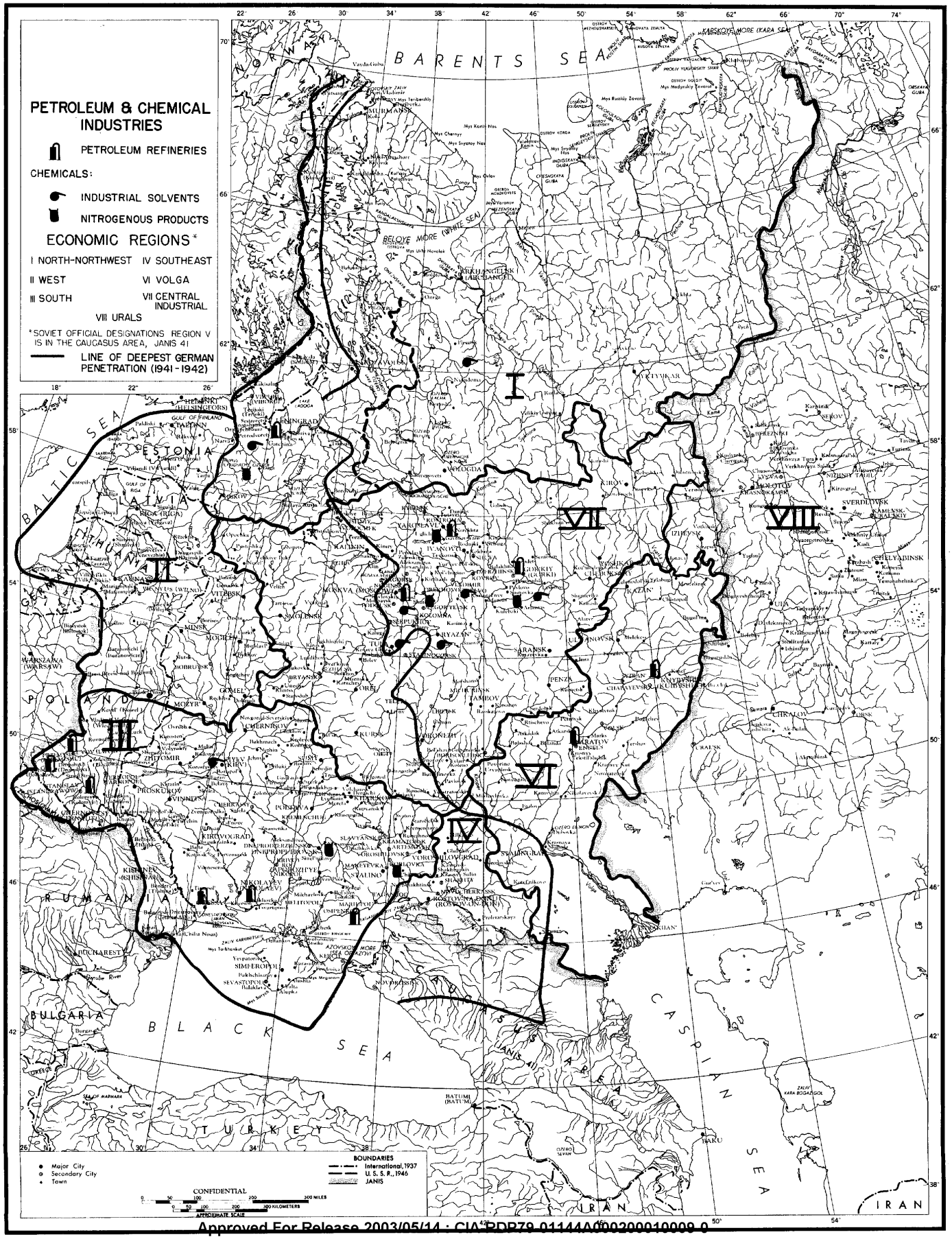


FIGURE IX-66
MUNITIONS INDUSTRY
JANIS 40
~~CONFIDENTIAL~~

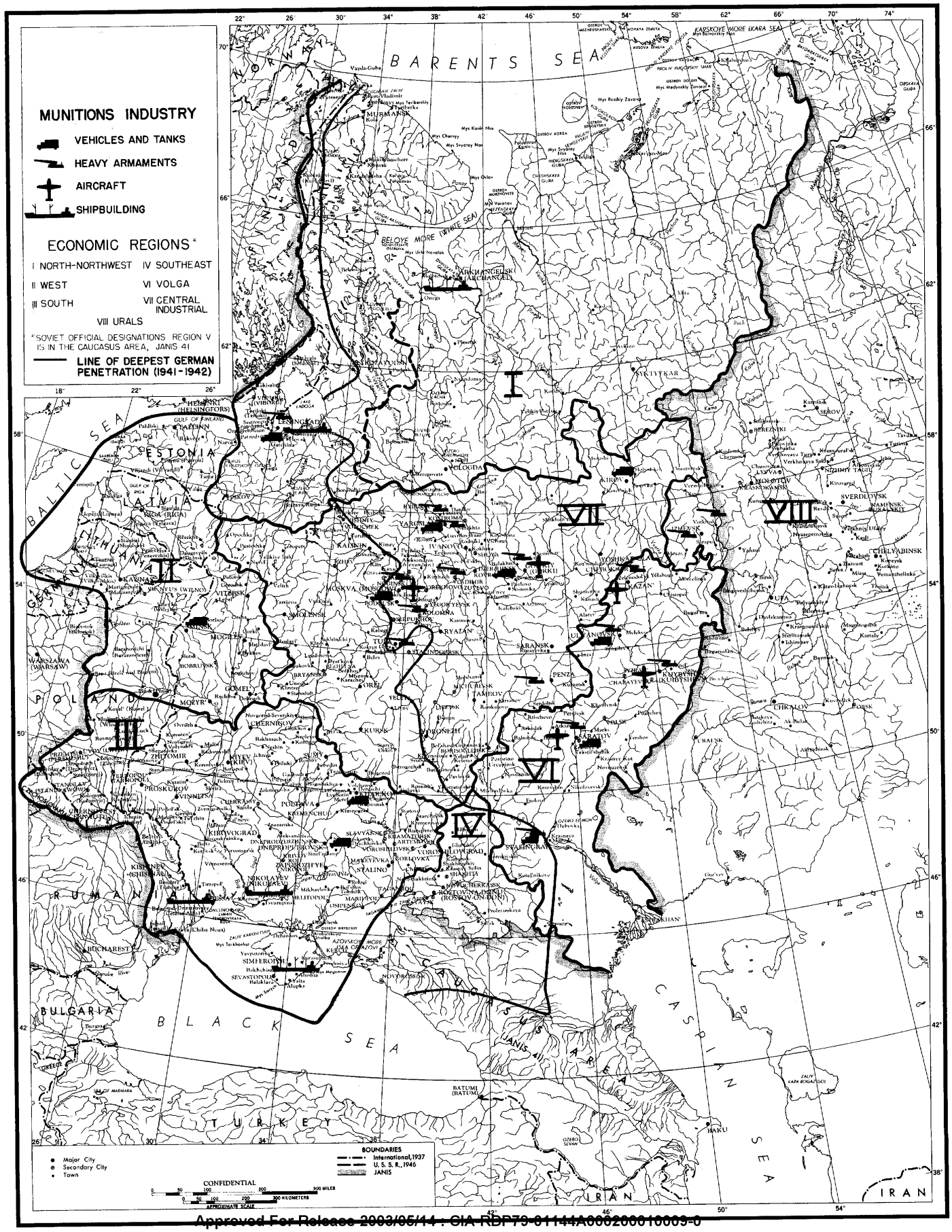


TABLE OF CONTENTS (Continued)

	Page
E. Cement	IX - 30
F. Brick and tile	IX - 30
G. Other construction materials	IX - 30
95. MINERAL RESOURCES	IX - 30
A. General	IX - 30
(1) Minerals	IX - 30
(2) Fuels	IX - 30
B. Minerals other than fuels	IX - 31
(1) Iron ore	IX - 31
(2) Ores of ferro-alloy metals	IX - 32
(3) Nonferrous metals	IX - 32
(4) Nonmetallic mineral resources	IX - 33
C. Fuels	IX - 34
(1) Coal	IX - 34
(2) Peat	IX - 35
(3) Firewood	IX - 35
(4) Petroleum	IX - 35
(5) Natural gas	IX - 36
96. ELECTRIC POWER	IX - 36
A. General	IX - 36
(1) Power development and resources	IX - 36
(2) Projects planned and under construction	IX - 38
(3) Current characteristics	IX - 38
(4) Administration	IX - 39
B. National and regional networks	IX - 39
(1) Pattern and significance	IX - 39
(2) Transmission systems	IX - 45
(3) Distribution networks	IX - 48
(4) Thermal plants	IX - 49
(5) Hydroelectric resources, development, and projects	IX - 51
(6) Consumption of electric power	IX - 55
(7) Available surplus over peak loads	IX - 55
(8) Railway electrification	IX - 56
C. Electrical manufacturing	IX - 56
(1) Power machine industry	IX - 56
(2) Transmission equipment	IX - 57
97. MANUFACTURING	IX - 81
A. General	IX - 81
(1) Planning	IX - 81
(2) Organization	IX - 81
(3) War damage	IX - 82
(4) Reconversion, reconstruction, and reparations	IX - 83
(5) Multiplication of products	IX - 83
(6) Labor	IX - 85
(7) Trend	IX - 86
(8) Underground	IX - 86
B. Manufacturing plants and products	IX - 87
(1) Mineral processing	IX - 87
(2) Machine building	IX - 94
(3) Chemical industry	IX - 106
(4) Petroleum refining	IX - 109
(5) Armament and munitions	IX - 112
(6) Shipbuilding	IX - 115
(7) Aircraft	IX - 119
(8) Wood products and paper	IX - 121
(9) Building materials	IX - 123
(10) Consumer goods	IX - 125
(11) Optical and precision instruments, and medical equipment	IX - 129
(12) Electrical and communications equipment	IX - 130
(13) Local industry and producers' cooperatives	IX - 133
(14) Storage facilities	IX - 134
98. COMMERCE AND FINANCE	IX - 135
A. Commerce	IX - 135
(1) General	IX - 135
(2) Foreign trade	IX - 135
(3) Internal commerce	IX - 137
B. Finance	IX - 137
(1) Currency	IX - 137
(2) Foreign exchange and value of the ruble	IX - 138
(3) The banking system	IX - 138
99. PRINCIPAL SOURCES	IX - 139
A. Principal sources for Topics 91 and 92	IX - 139
(1) Evaluation for Topics 91 and 92	IX - 139
(2) List of references	IX - 139
B. Principal sources for Topics 93, 94, and 95	IX - 140
(1) Evaluation for Topics 93, 94, and 95	IX - 140
(2) List of references	IX - 141

Produced by

Department of State
Department of the Army
Department of the Navy
Department of the Air Force

Published by

THE CENTRAL INTELLIGENCE AGENCY

WASHINGTON, D. C.

~~Confidential~~

U. S. GOVERNMENT PRINTING OFFICE
2698—S—1948

Approved For Release 2003/05/14 : CIA-RDP79-01144A000200010009-0