PROVISIONAL INTELLIGENCE REPORT

ELECTRIC POWER IN THE VOLGA REGION OF THE USSR

CIA/RR PR-129
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CENTRAL INTELLIGENCE AGENCY

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ELECTRIC POWER IN THE VOLGA REGION OF THE USSR

CIA/RR PR-129
(ORR Project 27.594)

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ELECTRIC POWER IN THE VOLGA REGION OF THE USSR*

Summary

The production of electric power in the Volga region (Economic Region VI**) of the USSR is important to the industrial development not only of the region itself but also of the entire European USSR. The Volga region lies between the highly industrialized Region VII (Central) and the resource-rich Region VIII (Urals). As the extensive planned additions to the electric power facilities of the Volga region are completed, the region will play a vital part in the integration of the electric power supply of the European USSR.

The estimated installed generating capacity*** in the Volga region in January 1955 was only 1.3 million kilowatts (kw), about equal to that of the State of Louisiana, and the production of electric power was only 4 percent of total Soviet production. The completion of major hydroelectric projects now under construction will quadruple the 1955 installed capacity, and by 1962 the Volga region will produce 8 percent of total Soviet electric power.

The major electric power projects now under construction in the Volga region are the Kuybyshev and Stalingrad hydroelectric stations. Kuybyshev will have a generating capacity of 2.1 million kw and will be the largest hydroelectric station in the world. Stalingrad will have a generating capacity of 1.8 million kw and will be the second largest hydroelectric station in the USSR. These projects were originally scheduled for completion and operation at full capacity by 1955 and 1956, but it is unlikely that either station will be operating at full capacity before 1961.

* The estimates and conclusions contained in this report represent the best judgment of ORR as of 1 September 1955.

** Unless a "power region" is specifically designated, the term region in this report refers to the economic regions defined and numbered on CIA Map 12048.1 9-51 (First Revision, 7-52), USSR: Economic Regions.

*** Installed generating capacity is the aggregate of kilowatt ratings of installed generating equipment.

The electric power produced by the Kuybyshev and Stalingrad hydroelectric stations will be distributed by transmission lines now being constructed or designed. A Kuybyshev-to-Moscow line is now near completion, and a Stalingrad-to-Moscow line may be under construction. Both of these lines are designed to operate at the world's highest voltage -- 400,000 volts. Other high-voltage lines (220,000 or 400,000 volts) will connect the transmission network of the Volga region with the Dnepr-Donets network to the west and the Urals network to the east. It is possible that the entire transmission system will be completed by 1960, the target date set by Soviet officials.

In 1954 the production of hydroelectric power in the Volga region was insignificant. About 80 percent of the electric power was produced by plants burning coal and about 20 percent by plants burning local fuels -- oil shale, natural gas, and residual fuel oil. Coal was imported from the Donets and Karaganda basins and from other coal-mining areas, some at distances of more than 1,000 kilometers. It is likely that there will be little increase in the total production of thermal electric power in the region, but it is probable that the use of local fuels will increase and will account for a greater percentage of the total production of thermal electric power.

About 82 percent of the electric power consumed in the Volga region in 1954 was consumed by industry -- petroleum, chemicals, machine building, aircraft, ferrous metallurgy, and shipbuilding. Now under construction in Stalingrad is an aluminum plant which will consume annually about 1.5 times the total electric power produced in Stalingrad in 1954.

When the Kuybyshev and Stalingrad hydroelectric stations are completed, the supply of electric power in the Volga region will be more than sufficient to meet the demands of all consumers in the region. It is estimated that about 50 percent of the total electric power produced in the region in 1962 will be transmitted to other regions -- primarily to the Moscow area -- and that the Volga region will be the largest regional exporter of electric power in the USSR.

As of 1955 the apparent vulnerability of the electric power industry in the Volga region lies in the fact that about 80 percent of production depends on transport of coal from distant sources and in the lack of a transmission network connecting the large regional industrial centers. These weaknesses, however, will be eliminated

by 1962, when the new hydroelectric stations will produce about four-fifths of total regional production and an adequate transmission network will be in operation. A vulnerability not now existing will be created by the completion of the Kuybyshev and Stalingrad hydroelectric plants. Those 2 plants will contain about 70 percent of the total electric power generating capacity of the region and will produce an important part of the electric power supply of the vital Moscow area.

Although the patterns of production and consumption of electric power normally cannot be considered good indicators of national intentions, the present Soviet policy of constructing major hydroelectric stations in the Volga region, rather than thermal electric plants requiring smaller investment and shorter periods of construction, seems to indicate that the USSR does not intend to begin hostilities in the near future.

I. Introduction.

The development of the electric power industry in the Volga region is of particular significance because of the region's great potential for industrial expansion. Although the Volga region accounted for only 6 percent of the Soviet gross national product in 1954, 1/* the completion of two large hydroelectric stations at Kuybyshev and Stalingrad during the 1955-62 period will provide a power base for a much larger share of total Soviet production.

The geographical area covered in this report includes the RSFSR oblasts of Astrakhan', Stalingrad, Saratov, Kuybyshev, Ul'yanovsk, and Balashov and Tatar ASSR. This area is centrally located west of the Urals and covers the wide valley of the Volga River from the vicinity of Kazan' southward to Astrakhan' on the shores of the Caspian Sea.

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* For serially numbered source references, see Appendix E.

The area is divided into the following three "power regions" 2/: No. 14, the Tatar, covers Tatar ASSR; No. 15, the Middle Volga, includes Ul'yanovsk, Kuybyshev, and Saratov Oblasts; and No. 16, the Lower Volga, includes Stalingrad and Astrakhan' Oblasts. Practically all of the industrial activity in the Volga region is centered in and around seven cities located along the banks of the Volga -- Kazan', Ul'yanovsk, Kuybyshev, Syzran', Saratov, Stalingrad, and Astrakhan'. 3/ The region covers 187,000 square miles, contains about 5 percent of the population of the USSR, and produces about 4 percent of the total Soviet electric power.

In this report, detailed discussion of power plants is limited to those having capacities of at least 1,000 kw. Identified plants of less than 1,000-kw capacity, except rural power plants, are listed by location, and an estimate of their aggregate capacity is made. Transmission lines with a potential of at least 35 kilovolts (kv) are covered. A study of the distribution facilities within cities and urban communities, however, is not within the scope of this report. Some data on power consumption are presented, and an attempt is made to establish a consumption pattern in broad economic categories, but it has not been possible to account clearly for the distribution of total power production to the eventual user.

II. Organization and Administrative Structure.

The organization and control of the electric power industry in the Volga region is held by four groups, as follows: (1) the Ministry of Electric Power Stations (Ministerstvo Elektrostantsiy -- MES) controls the State Regional Electric Power Stations (GRES*), which have 64 percent of the total installed capacity of the Volga region and, like public utilities in the US, supply all types of consumers; (2) various industrial ministries control industrial power plants, which have 25 percent of the total capacity of the Volga region and supply primarily the industrial plants in which they are located; (3) the Ministry of Communal Economy, RSFSR, controls municipal power plants, which have 7 percent of the total capacity of the Volga region and supply primarily municipal and residential consumers; and (4) the

* Gosudarstvennaya Rayonnaya Elektrostantsiya, a power plant which is operated by the MES.

Ministry of Agriculture controls rural power plants, which have 4 percent of the total capacity of the Volga region and supply rural communities and farms.

Of these four groups, the MES is the most important because it controls, administratively and operationally, nearly two-thirds of the electric facilities of the Volga region and, to a varying degree, has operational relations with the other three groups. The channels of MES control 4/ are shown in the accompanying chart.*

The 6 power systems are under the supervision of 3 Chief Directorates, which in turn report to the MES, an All-Union Ministry with headquarters in Moscow. The fact that 3 of the 5 Chief Directorates of Power for the whole of the USSR are involved in this region is somewhat unusual and is largely a result of the fact that the administrative boundaries of the Directorates overlap within this geographical area. Also there may be internal political and personality factors which enter into this apparently unnecessary dispersal of authority.

The construction of new electric power facilities falls within the jurisdiction of the Ministry of the Construction of Electric Power Stations (Ministerstvo Stroitel'stva Elektrostantsiy -- MSES). Electric power construction activities were formerly a function of the MES, but in what appears to have been an effort to departmentalize and speed up lagging construction, these activities were divorced from the MES in November 1954. 5/ Within the MSES there are separate organizations in charge of major projects -- the Kuybyshev GES** Construction Trust (Kuybyshevgidrostroy) and the Stalingrad GES Construction Trust (Stalingradgidrostroy) are in charge of the two hydroelectric projects at Kuybyshev and Stalingrad, respectively. 6/

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* Following p. 6.

** Gidroelektrostantsiya (Hydroelectric Power Station).

III. Generation and Transmission Facilities.

A. Natural Resources.

Of the principal sources of primary energy -- solid fuels, petroleum, natural gas, and waterpower -- the Volga region lacks only reserves of coal. The discovery and exploitation of petroleum and natural gas, however, has taken place only within the past 15 to 18 years, and there was no significant development of waterpower until the present Five Year Plan (1951-55).

Although the Volga region will have the two largest hydroelectric stations in the USSR, its waterpower resources represent only slightly more than 2 percent of the national total, and power now generated by hydroelectric stations represents only a fraction of 1 percent of the total regional production. When they are completed, the Kuybyshev (2.1 million kw) and Stalingrad (1.8 million kw) hydroelectric stations on the Volga River will utilize a large portion of the estimated 6.5 million kw 7/ of waterpower potential* in the region.

Although the waterpower potential of the Volga River constitutes the preponderance of that in the region, small rivers such as the Medveditsa and Khoper are capable of minor hydroelectric development, and several small hydroelectric power plants are now being constructed to serve agricultural and rural consumers.

Because no coal is mined in the Volga region and because there are no coal resources which warrant exploitation, the region imports all of its coal, mainly from the Donbas and Karaganda areas.

According to a 1936 Soviet source, 8/ there were no oil resources in the Volga region at that time. Since then, however, oil was discovered near Syzran' and Kuybyshev and later in Saratov and in the southeastern section of Tatar ASSR. In 1954 the oil production of the Volga region constituted over 20 percent 9/ of total Soviet production.

* Theoretical capacity with stream flow available 50 percent of the time.

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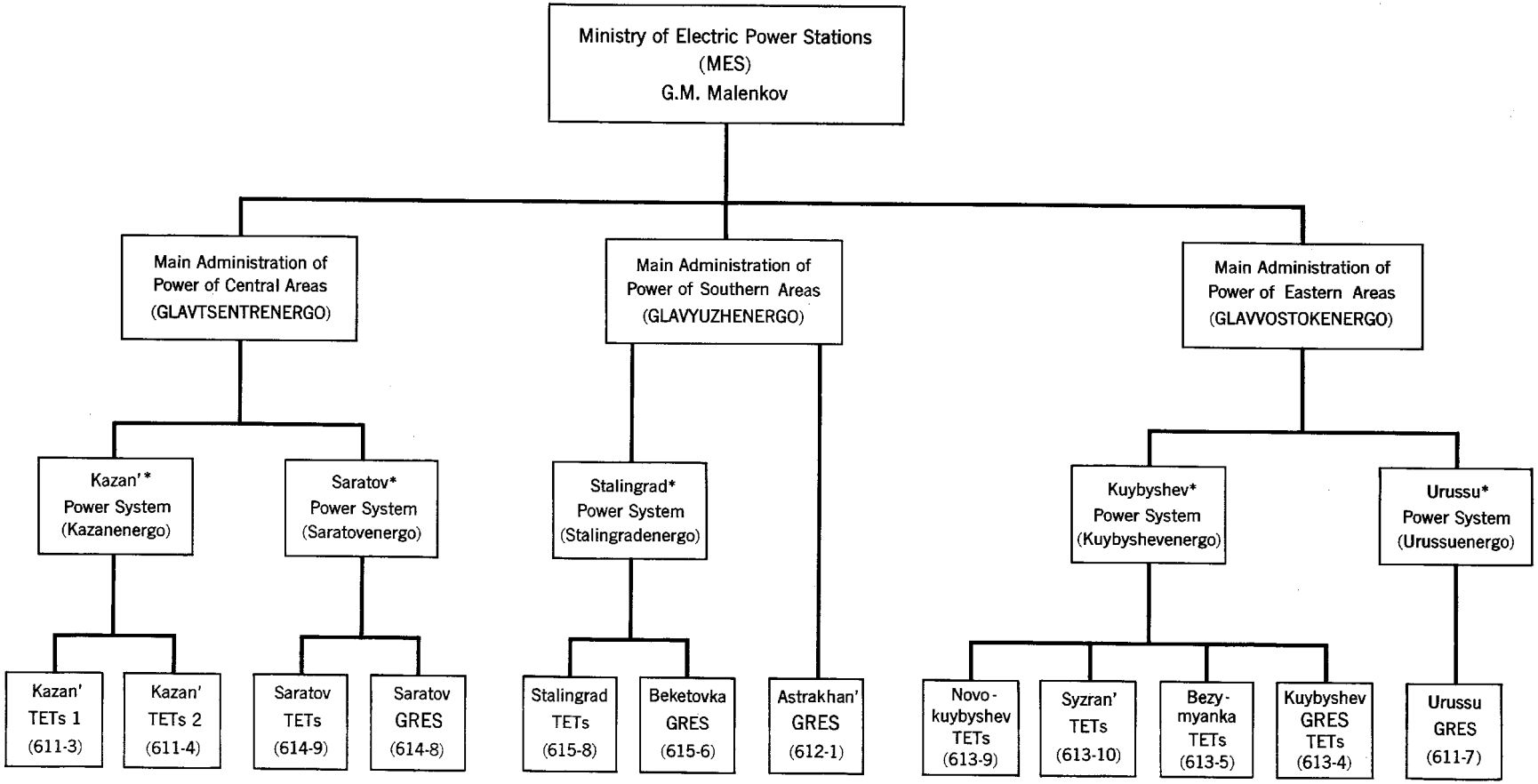
ORGANIZATION OF THE MINISTRY OF ELECTRIC POWER STATIONS IN THE VOLGA REGION OF THE USSR



*Power System Dispatcher has control over certain operations of industrial and municipal power plants connected with the system.

Power Plant numbers refer to plant list, Appendix A.

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In spite of this considerable production, liquid fuels constitute a minor source of primary energy for the generation of electric power. Oil is consumed in power plants representing only 7 percent of the total installed capacity in plants of at least 1,000 kw. The percentage would be larger if power plants of less than 1,000 kw were included. In the smaller plants, oil is used to a greater extent and may thus account for as much as 10 percent of the total.

Although natural gas was first found in the Volga region in 1906, exploitation was not begun until 1941, when fields at Yelshanka, near Saratov, were tapped. 10/ Natural gas from the Saratov area is now piped to Moscow, and additional deposits in Kuybyshev and Stalingrad Oblasts are being exploited. Natural gas is thus becoming a significant energy source for the region. Although natural gas is not extensively consumed as a fuel for power plants at present, its use probably will increase in the future.

Oil shale deposits are located in the eastern part of Saratov Oblast, south of Syzran', and north of Ul'yanovsk. These deposits, estimated to be over 13 billion metric tons,* 11/ constitute nearly one-fourth of the total Soviet shale resources and are the only important source of solid fuel for the region's industry and communal economy. At least 10 percent of the capacity of power plants of 1,000 kw and more is in shale-burning plants.

B. Generating Facilities.

The installed generating capacity of the Volga region in January 1955 is estimated at 1.3 million kw -- nearly 4.5 percent of the total capacity of the USSR, equal to that of China proper, and approximately equal to that of the State of Louisiana. The estimated installed electric power generating capacity in the Volga region of the USSR in January 1955 is shown in Table 1.**

* Tonnages are given in metric tons throughout this report.
** Table 1 follows on p. 8.

Table 1

Estimated Installed Electric Power Generating Capacity
in the Volga Region of the USSR
January 1955

Plant Category	Number of Plants	Installed Capacity (Thousand Kilowatts)
Identified plants of 1,000 kw and more	67	1,194
Identified plants of less than 1,000 kw other than rural (average capacity estimated to be about 500 kw)	98	50
Rural power plants a/	2,000	60
Total b/	2,165	1,304

a. It is estimated that in the USSR there are 33,000 rural power plants with a total capacity of 1 million kw. 12/ The Volga region accounts for about 6 percent of Soviet agricultural production, 13/ and this ratio has been used to derive the regional estimate of rural power plant capacity.
b. There are unidentified power plants in the region, but the total probably represents at least 95 percent of total capacity.

Although electric power generating capacity in the Volga region has increased at about the same rate as that of the USSR as a whole, there will be a much more rapid expansion during 1955-62 as generating units of the Kuybyshev GES and the Stalingrad GES become operative. By 1962, regional capacity should account for at least 8 percent of total Soviet capacity.

During World War II there was some damage to power plants in the Volga region, but this damage was confined largely to the Stalingrad area, and by 1948 the damaged plants were restored to prewar capacity. 14/ Lend-Lease generating equipment from the US and equip-

ment dismantled from power plants in East Germany were significant factors in the restoration. The reconstructed city of Stalingrad now has a 200,000-kw power plant, the largest in the region. Practically all of the installed electric power capacity in the region, including that of the present Stalingrad plant, is in thermal electric plants -- somewhat surprising in a region in which the largest hydroelectric power plants in the USSR are being constructed and which has no supplies of indigenous coal.

The major electric power plants in the Volga region of the USSR in 1955 are shown in Table 2. The 18 plants included in Table 2 account for more than three-fourths of the total capacity of the region, and all are thermal electric plants.

Table 2

Major Electric Power Plants in the Volga Region of the USSR
1955

Location and Plant Identification	Installed Capacity (Thousand Kilowatts)
Tatar ASSR	
Kazan' TETs 1 a/*	66
Kazan' TETs 2	120
Urussu GRES	37
Astrakhan' Oblast	
Astrakhan' GRES, TETs	75

* The footnote for Table 2 follows on p. 10.

Table 2

Major Electric Power Plants in the Volga Region of the USSR
1955
(Continued)

Location and Plant Identification	Installed Capacity (Thousand Kilowatts)
Kuybyshev Oblast	
Chapayevsk TETs	25
Kuybyshev GRES, TETs	52
Kuybyshev, Bezymyanka TETs	100
Novo-Kuybyshev TETs	24
Syzran' GRES, TETs	24
Saratov Oblast	
Saratov GRES	73
Saratov TETs	37
Saratov TETs (ball-bearing plant)	24
Saratov, Krasnodar TETs	24
Stalingrad Oblast	
Stalingrad, Beketovka GRES	200
Stalingrad, Tractor Plant TETs	50
Stalingrad, new TETs	24
Stalingrad, Red October Works	24
Ul'yanovsk Oblast	
Ul'yanovsk, MV Plant TETs	24

a. Teploelektrotsentral' (Heat and Electric Power Plant), a plant which supplies heat as well as electric power.

1. Distribution by Administrative Control and Size.*

Power plants operated by the MES supply all types of consumers and account for nearly two-thirds of the total installed electric power capacity of the Volga region. Seven of the 12 MES plants account for more than half of the total regional capacity. Capacities of the 12 MES plants range from 24,000 to 200,000 kw.

Capacity in 80 power plants primarily serving industrial enterprises accounts for nearly one-fourth of the total, most of which is in plants in the 10,000- to 50,000-kw range.

All Ministry of Communal Economy (RSFSR) plants are of less than 10,000 kw and account for at least 7 percent of regional capacity. Most of these plants are in small, isolated communities, not connected to a power system, and supply local municipal and residential consumers.

Under the control of the Ministry of Agriculture there are about 2,000 rural power plants with an aggregate capacity of 60,000 kw -- a capacity equal to one of the smaller MES power plants. Rural power plants constructed in 1954 have an average capacity of 75 kw, compared with the average of 30 kw 15/ for existing rural power plants. Two rural hydroelectric power plants under construction on the Medveditsa River will have capacities of 2,000 kw each and will be the largest rural power plants in the region. 16/

2. Distribution by Area.**

Of the nearly 1.2 million kw of installed capacity of power plants of 1,000 kw and more, the 7 industrial centers located along the Volga River account for almost 90 percent. About 60 percent, moreover, is accounted for by the three largest industrial centers -- Stalingrad, Kazan', and Kuybyshev. In terms of installed capacity, Stalingrad is the largest.

* For detailed information on the power plants falling within the several categories of administrative control in the Volga region, see Appendix A.

** See the map, USSR: Major Power Plants and Transmission Lines in the Volga Region, 1955, inside back cover.

The high concentration of electric power capacity in seven industrial centers in the Volga region of the USSR is shown in Table 3.

Table 3

Concentration of Electric Power Capacity in Seven Industrial Centers in the Volga Region of the USSR

Political Subdivision and City	Capacity (Thousand Kilowatts)	
	Political Subdivision	City
Tatar ASSR	246	
Kazan'		204
Balashov Oblast	8	
Astrakhan' Oblast	87	
Astrakhan'		85
Kuybyshev Oblast	276	
Kuybyshev		201
Syzran'		38
Saratov Oblast	211	
Saratov		167
Stalingrad Oblast	312	
Stalingrad		308
Ul'yanovsk Oblast	54	
Ul'yanovsk		50
Total	1,194	1,053

With the exception of Kuybyshev and Syzran' the power systems of the seven cities have no interconnections and operate independently. This handicap to integrated industrial development will soon be reduced by a proposed transmission line from Kuybyshev to Astrakhan'.

Balashov Oblast, primarily an agricultural area, was recently created from former territory of Saratov and Stalingrad Oblasts and a section of the adjoining Central region. It has little industrial activity and only a small amount of electric generating capacity.

3. Distribution by Type of Fuel Consumed.*

Discussion of the types of fuel used in electric power plants in the Volga region is limited to those plants with installed capacities of 1,000 kw and more. Plants of less than 1,000 kw account for less than 10 percent of the total regional capacity.

The types of fuels used in electric power plants, in the order of the quantity used, are coal, oil shale, residual fuel oil (mazut), diesel oil, and natural gas. It is of considerable economic significance that less than 20 percent of the electric power capacity of the region uses so-called local fuels, a condition which not only increases costs of operation but also throws a burden on transport facilities. Coal is used for 81 percent of the regional electric power plant capacity. All of the coal is imported, principally from the Donbas and Karaganda coal fields, and haulages ranging up to 1,000 kilometers are required.

Shale-burning electric power plants account for about 10 percent of regional capacity. Oil shale, the only local solid fuel of significance, is practically all consumed in power plants in Kuybyshev and Saratov Oblasts. The proportion of shale-burning plants, however, is expected to increase in the future, partly through conversion of existing coal-burning plants to the use of oil shale.

Residual fuel oil and diesel oil are consumed mainly in relatively small plants which account for about 7 percent of the regional capacity. This percentage probably would increase to 10

* For details of the distribution of power plant capacity in the Volga region by types of fuels, see Appendix A.

percent if plants of less than 1,000 kw were considered. Residual fuel oil is consumed in power plants in or near refineries, and diesel oil is consumed in small, isolated power plants.

Natural gas is another local fuel which may have greater regional significance in the future. Although the use of natural gas as fuel has been definitely determined in only 2 percent of electric power plant capacity, its actual use may be somewhat greater. In some cases, coal- or oil-burning plants use natural gas as a secondary fuel, but the amount thus consumed is not known.

C. Transmission Lines.

The Volga region has no regional network for exchange of electric power between its major industrial centers. This lack of power exchange has been a handicap in the development of industrial and electric power in those centers. Interconnection of major power plants would permit the operation of the larger plants at full loads and, therefore, at their best efficiencies; it might permit the use of smaller, less efficient plants only at times of peak load or in emergencies. Such operations would, in effect, increase electric power capacity with no capital investment for new generating units -- thus offsetting, either completely or to a considerable degree, the investment in transmission facilities. A more dependable supply to the consumers would also be provided. Long-distance transmission lines from the great Kuybyshev and Stalingrad hydroelectric plants, now under construction, are planned and will provide the base for a regional network.*

The Kuybyshev power system has a greater degree of interconnection than the others. It includes power plants and consumers in Kuybyshev and nearby localities such as Syzran', Chapayevsk, the Yablon'ka oilfields, and the construction site of the Kuybyshev GES. Power plants with an installed capacity of about 275,000 kw, 200,000 kw in the city and environs of Kuybyshev, comprise the network.

There are two known transmission lines traversing regional boundaries, and these export a small amount of power to other regions.

* For a listing of the few existing transmission lines in the Volga region, see Appendix A.

A line from Kazan' to Volzhsk in the Central region (Region VII) carries a small interchange of power, and most of the power generated at Urussu is transmitted to the Tuymazy oilfields, mainly in the Urals region (Region VIII). There may be a line from Stalingrad to Tsimlyanskiy in the Southeast region (Region IV), but this line has not been confirmed.

IV. Production and Consumption.

A. Production.

There are virtually no available data on the production of electric power in the Volga region during the postwar period. It has been necessary, therefore, to establish annual production figures by relating the installed capacity to the number of hours of its utilization during 1 year.*

In the US electric power industry in 1953 the average hours of utilization per year were 5,092. 17/ The average for the industry in the USSR is estimated to be about the same. Taking into consideration the over-all characteristics of the electric load in the Volga region, a figure of 4,500 hours has been used to arrive at the production estimated for 1954. This figure is a maximum, and it is possible that actual production may be 10 percent below the estimated 5.9 billion kwh produced in 1954. This estimated 1954 production is 3.5 times that for 1937 18/ and is 4 percent of the total 1954 Soviet production. The estimated production of electric power in the Volga region of the USSR in 1954-62 is shown in Table 4.**

B. Consumption.

1. By Economic Categories.

The 1954 consumption pattern of the Volga region by economic categories does not differ materially from that of the***

* Installed capacity in kilowatts times the hours of operation equals kilowatt-hours (kwh).

** Table 4 follows on p. 16.

*** Continued on p. 18.

Table 4

Estimated Production of Electric Power in the Volga Region of the USSR a/
1954-62

Year	Thermal Electric Plants b/		Hydroelectric Plants		
	Production (Billion Kilowatt-Hours)	Percent of Total Production	Kuybyshev GES c/ (Billion Kilowatt-Hours)	Stalingrad GES d/ (Billion Kilowatt-Hours)	Total (Billion Kilowatt-Hours)
1954	5.9	100	0	0	5.9
1955	6.0	100	e/	0	6.0
1956	6.2	76	2.0	0	8.2
1957	6.4	58	4.0	0.6	11.0
1958	6.6	44	6.0	2.4	15.0
1959	6.9	35	8.0	4.7	19.6
1960	7.1	30	9.5	7.1	23.7
1961	7.3	28	10.0	9.1	26.4
1962	7.6	28	10.0	10.0	27.6

a. Production estimates are derived by multiplying the average capacity during each year by an hours-of-utilization figure as noted in footnotes b, c, and d. Average capacity during each year was figured as the capacity at the beginning of the year (see Table 7, p. 26, below) plus one-half of the capacity added during the year. The average capacity in 1954 was taken as the 1.3 million kw installed at the beginning of 1955. Figures are rounded to the nearest 100 million kwh.

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Table 4

Estimated Production of Electric Power in the Volga Region of the USSR a/
1954-62
(Continued)

b. Hours of utilization for thermal electric power plants are assumed to remain at the estimated 1954 level of 4,500 hours for the 1955-62 period. A few very small hydroelectric plants will be constructed during this period, but the aggregate is considered insignificant.
c. Based on planned production of 10 billion kwh from a capacity of 2.1 million kw, hours of utilization will be 4,750 hours.
d. Based on planned production of 10 billion kwh from a capacity of nearly 1.8 million kw, hours of utilization will be 5,600 hours.
e. The first generating units are to be installed during the last quarter of 1955, possibly in December, and actual production in 1955 is assumed to be negligible.

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USSR as a whole. The principal difference is the absence of consumption by electrified railroads in the region. Although some railroad lines are to be electrified and such construction is reported under way, 19/ no power was consumed in this category in 1954. Industry consumes the greater portion, over four-fifths, while the proportion consumed by residential and municipal consumers, about one-sixth, is about one-third of that in the US. The estimated electric power consumption pattern in the Volga region of the USSR, by economic category, in 1954 is shown in Table 5.

Table 5

Estimated Electric Power Consumption Pattern in the Volga Region of the USSR, by Economic Category
1954

Category	Billion Kilowatt-Hours	Percent of Total Consumption
Industry	3.95	82 a/
Residential and municipal (includes street railway)	0.77	16 b/
Agriculture and rural economy	0.12 c/	2
Total	4.84 d/	100

a. Industrial consumption is reported to be two-thirds of production in the USSR as a whole. 20/
b. Consumption of residential and municipal consumers in the USSR is reported to be 13 percent of production. 21/
c. 60,000 kw x 2,000 hours of utilization.
d. Total consumption equals production minus power plant use and transmission loss (estimated at 18 percent of production, or 1,060 million kwh).

The consumption pattern will differ materially when the Kuybyshev and Stalingrad hydroelectric stations are operating at full capacity. Of the estimated 1962 production of 27.6 billion kwh, about 24.8 billion will be made available to Volga region consumers and for export.* The estimated electric power consumption pattern in the Volga region of the USSR, by economic category, in 1962 is shown in Table 6.

Table 6

Estimated Electric Power Consumption Pattern in the Volga Region of the USSR, by Economic Category
1962

Category	Billion Kilowatt-Hours	Percent of Total Consumption
Exports	12.3	50
Industry	6.9	28
Agriculture and rural economy (principally for irrigation purposes)	2.8	11
Residential and municipal	2.3	9
Electrified railroads	0.5	2
Total	24.8	100

a. Export.

Plans for 1962 call for exports of power to Moscow and other cities in Region VII of 11.3 billion kwh. 22/ Another 1 billion kwh may be exported to neighboring regions for irrigation purposes. Exports will thus amount to nearly one-half of the estimated consumption.

* It is estimated that power plant use and transmission losses will amount to 2.8 billion kwh (18 percent of production minus exports).

b. Agriculture and Rural Economy.

About 2.5 billion kwh are to be consumed in 1962 for irrigation purposes in the region. 23/ An additional 0.3 billion kwh may be consumed by other rural needs. The percentage of total consumption accounted for by this category will thus increase from 2 percent in 1954 to over 11 percent by 1962 if Soviet plans materialize.

c. Residential and Municipal.

It is planned to increase the percentage accounted for by this category to 15 percent of Soviet production in 1960. 24/ Fifteen percent of regional production minus exports (27.6 billion minus 12.3 billion kwh) would thus amount to 2.3 billion kwh, or about 9 percent of total consumption.

d. Electrified Railroads.

It is difficult to project the consumption by this category to 1962. It is estimated, however, that railroads will account for not more than 2 percent of total consumption, or about 0.5 billion kwh.

e. Industry.

If the estimates of consumption by other categories are accepted, less than 7 billion kwh would be available for industry in 1962, or 28 percent of total consumption. It is emphasized that the estimates of consumption by nonindustrial consumers are based largely on Soviet plans. It is entirely possible that consumption by irrigation facilities and by residential and municipal consumers will be considerably less than planned. The possibility that the proposed allocation for irrigation is mainly for propaganda purposes should not be overlooked. Industrial consumers have always had priority in the USSR at the expense of nonindustrial consumers, and there is every reason to believe that this policy will continue.

2. By Principal Industries.

It has not been possible to account for all of the estimated 3.95 billion kwh consumed by industry in 1954. Since no data on actual power consumption by industry or industrial plants are

available, consumption estimates are usually derived by applying a power consumption factor in kwh per unit against total annual output. An attempt has been made to determine consumption by some of the larger industrial consumers in the region, the aggregate amounting to less than half of the estimated industrial consumption.

a. Oil Extraction and Refining.

The 1954 crude oil production in the Volga region was about 11 million tons, or nearly 20 percent of total Soviet production. 25/ Based on 28 kwh per ton, 26/ this extraction process would require about 310 million kwh.

Refineries are located at Saratov, Kuybyshev, and Syzran'. To refine the 11 million tons of crude oil would require another 440 million kwh, based on an average factor of 40 kwh per ton. 27/ Oil extraction and refining would thus require about 750 million kwh.

b. Ferrous Metallurgy.

The 1954 production of steel ingots (nearly 10 percent in electric furances) and finished steel is estimated at 1.5 and 1 million tons, respectively. 28/ This would require at least 3.5 million kwh. 29/ The Red October and Red Barricade metallurgical plants in Stalingrad are the largest consumers, requiring over 250 million kwh. Other ferrous metallurgical plants are located at Saratov, Zelenodol'sk, and Kazan'.

c. Chemicals.

Chemicals produced in the region in 1954 include phosphorous, chlorine, calcium carbide, nitric and sulfuric acid, and synthetic rubber. Power requirements are estimated at 360 million kwh 30/ in chemical plants at Stalingrad (Beketovka plant), Kuybyshev, Chapayevsk, Kazan', and Bondyuzhskiy. The Beketovka plant in Stalingrad requires at least half of this amount.

d. Aircraft Engines and Airframes.

Plants producing aircraft engines and airframes are located at Kuybyshev, Saratov, and Kazan'. Requirements are estimated at 100 million kwh. 31/

e. Nonferrous Metallurgy.

There is no significant production of nonferrous metals in the region. A large aluminum reduction plant is under construction in Stalingrad, however, which will have an estimated annual production of 100,000 tons, 32/ requiring over 2 billion kwh,* about one and one-half times the estimated total production in Stalingrad in 1954. It will not go into full production until the Stalingrad GES is in operation.

C. Imports and Exports.

No data are available concerning the amount of power transmitted into or out of the Volga region in 1954. Although the region is believed to be a net exporter of power, the amount is insignificant when compared with the total amount produced. Some power may be transmitted to Volzhsk in Region VII from Kazan' and to the Tuymazy oilfields from Urussu.

This condition will be radically changed in the near future on the completion of the Kuybyshev and Stalingrad hydroelectric plants. In fact, their great size is designed not so much to add to the electric supply of the Volga region but rather to export, by long-distance transmission lines, more than half of their planned production. For example, 61 percent of the production of Kuybyshev and 40 percent of that of Stalingrad is to be transmitted to the Moscow area, in addition to which over 1.2 billion kwh 33/ have been allocated to the Tambov, Voronezh, Kursk, and Orel Oblasts of Region VII, and up to 1 billion kwh for irrigation pumping in the Caspian area.

* Based on a factor of 20,000 kwh per ton.

V. Growth of Facilities.

A. New Power Plants Planned or Under Construction.

All plans for the expansion of electric power generating facilities in the Volga region are overshadowed by the construction of the Kuybyshev and Stalingrad hydroelectric stations. These two power plants, together with existing plants, will be able to supply all electric power requirements for the foreseeable future. In addition, there have been reports of tentative plans to construct another hydroelectric station at Balakovo, between Kuybyshev and Stalingrad. 34/

New thermal electric power plants, when constructed, probably will burn shale or natural gas rather than coal, which has to be imported into the region. Soviet sources claim that shale mining in the Volga region could in the future supply fuel for power plants with a capacity of 700,000 kw. 35/ It is doubtful if the plan will be realized on such a grand scale, but it may be indicative of some planned additions of shale-burning power plants.

Most of the expansion in thermal electric capacity is expected to be in small power plants under 10,000 kw located in remote areas not connected to the regional transmission network. Small thermal electric power plants are known to be under construction at Novouzensk and Aleksandrov-Gay in Saratov Oblast, at Leninsk in Stalingrad Oblast, and at Karamysh and Sennaya (unlocated, probably in Saratov or Stalingrad Oblasts). 36/

Twelve 2,000-kw hydroelectric stations are planned on the Medveditsa River in the eastern section of Stalingrad Oblast. 37/ Two of these, at Mikhailovsk and Krasnoyarsk, are under construction and will serve collective and state farms. Other small hydroelectric stations are planned along the Khoper River, 38/ in the western sections of Saratov and Stalingrad Oblasts. The capacities of these probably will be 2,000 kw or less.

B. Enlargement and Rehabilitation of Existing Facilities.

There are no known plans for increasing significantly the generating capacity of existing power plants. Since large quantities of relatively cheap hydroelectric power will first become available in 1956, it is unlikely that significant expansion of existing generating facilities will occur.

Rehabilitation of war-damaged facilities was completed during the Fourth Five Year Plan (1946-50).

C. Transmission Lines Planned or Under Construction.

About 6,000 kilometers of 220- and 400-kv transmission lines will be constructed to distribute power generated at the Kuybyshev and Stalingrad hydroelectric stations, two-thirds of this amount being in 400-kv lines to Moscow (two parallel lines from each plant). These high-voltage lines will be the backbone of the planned grandiose network connecting all major power plants in the European USSR and the Urals. Malenkov, now Minister of Electric Power Stations, claimed in June 1955 that such a scheme will become a reality by 1960. 39/

The 400-kv line from Kuybyshev to Moscow is under construction and planned for partial operation by the end of 1955. It is planned 40/ to make available in the Moscow area 600,000 kw on each of its 2 circuits, thus amounting to more than half of the 2.1 million-kw installed capacity of the Kuybyshev GES. The operating voltage of this line is the highest used in the world, and creates many engineering problems concerning the design of transformers, circuit breakers, and other associated equipment.

Although no information has been received, construction may have started on the 1,000-kilometer, 400-kv double-circuit line from Stalingrad to Moscow which is scheduled for operation by the end of 1956. It will make available to the Moscow area nearly half of the 1.7 million kw of installed capacity and about 250,000 kw to cities in the Central region along its route.

About 2,000 kilometers of 220-kv lines will be constructed to distribute power to various cities in the Volga region. The creation of two such large sources of hydroelectric power as the Kuybyshev GES and the Stalingrad GES dictates a transmission line connecting them. This will be a 700-kilometer, 220-kv line from Kuybyshev to Stalingrad, 41/ via Saratov, the Kuybyshev-Saratov section of which is under construction. 42/ Considering the large amounts of power involved and the distance, it would seem reasonable to assume that this will be a double-circuit line.

It is planned to transmit power from Stalingrad to Astrakhan' and vicinity by a 400-kilometer, 220-kv line. 43/ A planned 200-kilometer, 220-kv transmission line from Stalingrad to Tsimlyansk GES 44/ in Rostov Oblast (Region IV) would effect a tie between the Volga region network and the Dnepr-Donets network, which extends from Tsimlyansk west to Odessa in the Ukraine (Region III). This will be an important link in the proposed European USSR transmission network and may be double circuited. There is an unconfirmed report of a 900-kilometer, high-voltage, direct current underground cable being planned from Stalingrad to the Donbas area. 45/

In line with the planned European USSR-Urals network, it is speculated that a 220- or 400-kv transmission line will be constructed connecting the Kuybyshev GES with Molotov or Ufa in the Urals region (Region VIII). Ufa appears to be the most logical terminal, and the line may eventually be extended to Chelyabinsk.

D. Estimate of Growth of Capacity through 1962.

The growth of the generating capacity of the Volga region during the next Five Year Plan (1956-60) depends directly on the rate at which generating units are installed at the Kuybyshev GES and the Stalingrad GES. Announcement was made in 1950 46/ that the Kuybyshev and Stalingrad hydroelectric stations were to be placed in operation at full capacity by 1955 and 1956, respectively. In 1954 the USSR claimed that the Kuybyshev GES would only be in "partial operation" by 1955, 47/ and later specified that only two generating units would be installed by that date. 48/ It is unlikely that the Stalingrad GES will be in even partial operation by the end of 1956. Considering the status of construction, it is not possible for the station to begin operation until 1957 or 1958. The bottleneck probably will occur in the installation of the turbines and generators rather than in the manufacture thereof. If the present rate of manufacture is maintained, all 37 generating units will be produced by 1959.

The installation of large generators and turbines is complicated and time consuming. Based on experience at other Soviet hydroelectric stations and in the US, it is estimated that about four generating units could be installed each year at each station.

Estimates of the installed capacities of these stations from 1955 to 1962, presented in Table 7, are based on the assumption that 2 generating units will be installed during the first year of operation and 4 per year thereafter until completed.

In addition to the installation of generating units at the Kuybyshev and Stalingrad hydroelectric stations, there will undoubtedly be some expansion of existing stations and construction of new generating facilities. Based on previous growth and the realization that the future growth of these facilities probably will be nominal, considering the large amounts of hydroelectric power to be made available, it is estimated that such expansion will not exceed 50,000 kw per year during the period 1955-62.

It is probable that a certain amount of old, inefficient generating equipment will be retired during this period. This amount probably will be small and has been neglected in deriving capacity estimates in Table 7, which shows the estimated expansion of generating capacity in the Volga region of the USSR in 1955-62.

Table 7

Estimated Expansion of Generating Capacity in the Volga Region of the USSR a/
1955-62

Beginning of Year	Kuybyshev GES		Stalingrad GES		Other Power Plants b/		
	Capacity (Thousand Kilowatts)	Units c/	Capacity (Thousand Kilowatts)	Units c/	Capacity (Thousand Kilowatts)	Percent of Total	Total Capacity (Thousand Kilowatts)
1955					1,300	100	1,300
1956	210	2			1,350	82	1,560
1957	630	6			1,400	69	2,030
1958	1,050	10	210	2	1,450	54	2,710
1959	1,470	14	630	6	1,500	42	3,600
1960	1,890	18	1,050	10	1,550	35	4,490
1961	2,100	20	1,470	14	1,600	31	5,170
1962	2,100	20	1,785	17	1,650	30	5,535

a. The absence of figures in any column in this table means zero.
b. With minor exceptions, all thermal electric power plants.
c. Generating units are rated at 105,000 kw each.

VI. Input Requirements.

A. Fuels.

Fuel requirements of power plants were determined in this report by applying conversion factors to estimated production. This method was necessary because actual data on fuel consumption are completely lacking. The results given here, however, are considered to be fair approximations of requirements. The estimated fuel requirements of electric power plants in the Volga region of the USSR are shown in Table 8.

Table 8

Estimated Fuel Requirements of Electric Power Plants in the Volga Region of the USSR a/
1954

Fuel	Thousand Metric Tons	Estimated Margin of Error (Percent)
Coal	2,840	-20 to + 5
Oil shale	1,200	-20 to + 5
Residual fuel oil (mazut)	90	- 5 to +25
Diesel fuel oil	60	- 5 to +25
Natural gas	40	- 5 to +50

a. Includes only power plants of 1,000 kw or more. See Appendix B.

Coal, by far the predominant fuel consumed for power generation, is all imported from outside the region, the major portion being anthracite culm from the Donbas area in Regions III and IV.

Karaganda coal is also imported, from Region X. Donbas coal is estimated to account for 60 to 80 percent of the coal imports to power plants. A large power plant in Kuybyshev, Bezymyanka TETs, was reported to have converted from Karaganda to Donbas coal in 1952. 49/ This may be indicative of a trend, and the proportion of Donbas coal may be increasing. It is estimated that one-sixth of total Donbas coal production and one-eighth of total Karaganda coal production is transported to the Volga region. 50/ Minor sources of additional coal include the Kuzbas (Region IX), Kizel' (Region VIII), and the Moscow basin (Region VII). 51/ Coal is thus imported into the Volga region from the north, south, east, and west.

Oil shale is the only local solid fuel of significance. The 1.2 million tons consumed in power plants in 1954 are believed to be the major part of oil shale production. Practically all of this was consumed in Saratov and Kuybyshev Oblasts. It is claimed that there is sufficient shale in the Volga region to supply power plants having an aggregate capacity of 700,000 kw, as well as to produce 5 billion cubic meters of gas, 15 million tons of cement, and 600,000 tons of light tar products. 52/ Oil shale is expected to have a larger share in the fuel balance in the future.

Residual fuel oil (mazut) requirements are also smaller than might be expected in an important oil-producing region. This is probably caused in part by a Soviet policy during the postwar period which encouraged the conversion of many power plants from burning residual fuel oil to coal, even in areas where residual fuel oil is considered a local fuel. 53/ One such instance in the Volga region is the TETs at the Stalingrad Tractor Plant, which converted from residual fuel oil to coal in 1949-50. 54/ Another case in point is that of the Urussu GRES, located in an oil-producing center of Tatar ASSR. In 1947 it was planned to use coal imported from Karaganda as the principal fuel of this GRES, while residual fuel oil and natural gas were considered as temporary secondary fuels. 55/

The Kuybyshev GRES converted from residual fuel oil to solid fuel in the prewar period. 56/

Diesel fuel oil is consumed only in small power plants, usually under 3,000 kw in capacity. About 60,000 tons are consumed in power plants of 1,000 kw or more. This is a minimum estimate, not considering power plants under 1,000 kw.

Power plants known to be burning natural gas as a principal fuel consumed 40,000 tons in 1954. In spite of frequent claims that several power plants, mainly in Saratov, converted to natural gas in the 1945-48 period, later information indicates that these power plants were consuming anthracite culm in 1953. 57/ A complaint was noted in a 1947 Soviet periodical to the effect that Saratov power plants should burn less natural gas so that there would be a larger supply for domestic and municipal consumers. 58/

B. Manpower.

Electric power plant personnel do not represent a significant portion of the total labor force. Total Soviet power plant personnel probably number about 400,000, of whom 300,000 are employed by the MES. 59/ Assuming that the ratio of personnel to installed capacity in the Volga region is similar to that in the USSR as a whole, the labor force would amount to 4 percent of 400,000, or 16,000 workers -- 12,000 of whom are employed in MES power plants. The ratio of personnel to installed capacity would then average 12.3 workers per 1,000 kw for all power plants. This estimate seems reasonable in view of the reported personnel per 1,000 kw of installed capacity in five of the region's largest power plants in 1947, as follows 60/:

Power Plants	Personnel per Thousand Kilowatts of Installed Capacity
Stalingrad GRES	10.9
Saratov GRES	10.5
Bezymyanka TETs	10.2
Kuybyshev GRES	14.0
Kazan' TETs 2	17.6

The number of personnel per 1,000 kw of installed capacity varies greatly in power plants, depending on the type of fuel consumed, the capacity of the plant and its location, and many other factors.

VII. Capabilities, Vulnerabilities, and Intentions.

A. Capabilities.

The electric power facilities of the Volga region appear to be capable of supplying the demands of existing industrial and municipal consumers. Future capability depends on the rate at which existing industrial production is increased and new large power-consuming industrial enterprises are established. It is believed that existing generating capacity plus that planned to be installed at Kuybyshev and Stalingrad during the next 5 years will be adequate for the foreseeable future.

B. Vulnerabilities.

The two principal economic vulnerabilities of the electric power industry in the Volga region concern transport of fuel and lack of power transmission lines between major industrial centers.

The transport of fuel constitutes a serious vulnerability because about 80 percent of the region's power is produced by coal-burning power plants and because all of this coal must be imported from coal fields hundreds of kilometers away. Any prolonged breakdown of rail transport, especially of lines going southwest to the Donbas, would soon curtail power production and, consequently, industrial production.

Any interruption to the operation of the major power plant in one of the region's industrial centers would radically affect electric supply because there are no transmission lines connecting the major industrial centers and therefore no adequate alternate sources of power. A case in point is Stalingrad, the largest industrial center in the region. Destruction of its largest power plant would reduce capacity by two-thirds. This vulnerability is emphasized by the fact that the destruction of seven plants would reduce the regional capacity by one-half.

These vulnerabilities will be reduced when the regional transmission network and the Kuybyshev and Stalingrad hydroelectric stations are in operation. Thermal electric power production will then be a small portion of total production, and by 1960 the dependence on the

transport of coal will be reduced. The proposed 220-kv regional transmission lines will provide alternate sources of supply for most of the industrial centers and will improve the efficiency of operation of generating facilities.

On their completion, the Kuybyshev and Stalingrad hydroelectric stations, will constitute 70 percent of the capacity of the Volga region, and they will also contribute heavily to the Moscow area supply.

C. Intentions.

Changes in electric power generating capacity or production cannot be considered in themselves good indications of intentions toward war. This is especially so when considering power facilities in only one small section of the country.

The present disposition of the USSR to emphasize the construction of large hydroelectric stations with the accompanying requirement of large investments and a long construction period of 5 to 10 years, rather than the construction of thermal electric stations with considerably smaller investments and a comparatively short construction period of 2 to 3 years, would seem consistent with long-range planning for a growing industrial economy in the Volga region.

APPENDIX A

ELECTRIC POWER FACILITIES IN THE VOLGA REGION OF THE USSR

1. Power Plants of 1,000 Kilowatts or More in the Volga Region of the USSR, January 1955.

All electric generating plants of 1,000 kw or more in the Volga region which were in operation on 1 January 1955 are listed below. The following comments explain the column headings:

Political Subdivision: Tatar ASSR is listed first, followed by oblasts in alphabetical order.

Location and Coordinates: Locations are listed alphabetically within political subdivisions. Power plants in small towns near a city are listed under the city rather than the town.

Unless otherwise indicated, coordinates are those given in the Preliminary NIS Gazetteer of the USSR.

Plant Number and Identification: The first three digits of the plant number specify the political subdivision in which it is located, according to a standard code used by OCD/IR. The first digit, 6, refers to Region VI, and the following two digits signify a political subdivision within the region -- that is, 11 for Tatar ASSR, 12 for Astrakhan' Oblast, and so on. The fourth digit is that assigned by the author to the power plant within the political subdivision.

Power plants within cities are identified by the name of the plant or by the industrial plant in which the power plant is located. They do not necessarily represent official Soviet designations but merely serve to identify the particular plant.

Subordination: The abbreviations refer to three categories of ministerial subordination, as follows: MES, Ministry of Electric Power Stations; MKK, Ministry of Communal Economy; and IM, Industrial Ministries. The plants subordinate to the fourth category, the Ministry of Agriculture, are not included in the tabulation.

Fuel*: The type of fuel consumed is not always clearly documented. Where more than one fuel is mentioned, the first listed is considered to be the principal source of energy. Residual fuel oil is designated merely as oil.

Installed Capacity: Estimates are presented to the nearest 1,000 kw. While they represent capacity as of 1 January 1955, little change in capacity has been noted in 1954, and the aggregate can be assumed with slight error to be the average installed capacity for 1954.

Remarks: Limited pertinent information is presented under Remarks. In most cases, additional details are available in ORR files.

* The symbol (?) in the tabulation indicates that the status is not definitely confirmed by documentation. The status shown appears to be justified, however, by taking into account such elements as location, size, and comparison with similar installations.

Political Subdivision	Location and Coordinates	Plant Number and Identification	Subordination	Fuel	Installed Capacity (Thousand Kilowatts)	Remarks
Tatar ASSR						
	Bondyuzhskiy 55°54'N - 52°20'E	611-1 Karpov Chemical Plant 61/	IM	Coal	2	In operation in 1934. Supplies chemical plant.
	Chistopol' 55°21'N - 50°37'E	611-2 Municipal Power Plant 62/	MKK	Oil	2	In operation in 1935. Supplies municipal and industrial consumers.
	Kazan' 55°45'N - 49°08'E	611-3 TETs imeni Stalin 63/	MES	Coal	66	Initial operation in 1933 with 20,000 kw. Supplies southern, older section of Kazan'.
		611-4 TETs 2 64/	MES	Coal	120	In operation in 1938, with one 25,000-kw unit. Expanded during and after the war. Supplies northern, newer section of Kazan', including aircraft factory.
		611-5 TETs 3 65/	IM	Coal	12	Supplies chemical warfare and explosives Plant No. 40 imeni Lenin and other consumers.
		611-6 Plant imeni 3d Anniversary of Tatar ASSR 66/	MKK	Coal	6	In operation in 1932. Serves municipal and domestic consumers, including streetcar system.
	Urussu 54°36'N - 53°24'E	611-7 GRES 67/	MES	Coal (Karaganda), oil, natural gas	37	Under construction in 1946. 12,000 kw in 1947, when it was planned to add a 10,500-kw, and a 15,000-kw unit. Supplies operations at Tuymazy oil fields.

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Political Subdivision	Location and Coordinates	Plant Number and Identification	Subordination	Fuel	Installed Capacity (Thousand Kilowatts)	Remarks
	Zelenodol'sk 55°50'N - 48°30'E	611-8 At shipyard 68/	IM	Diesel oil	1	Shipyard also receives power from Kazan'.
Astrakhan' Oblast	Astrakhan' 46°21'N - 48°03'E	612-1 GRES, TETs 69/	MES	Coal, anthracite culm	75	In operation in 1948 with 25,000 kw (construction began in 1935). Supplies industrial and domestic consumers.
		612-2 Municipal Power Plant 70/	MKK	Coal, oil	6	Old plant, possibly used only in emergency or for peak loads.
		612-3 Kapsi Slip Shipyard 71/	IM	Diesel oil	2	Completed in 1947, replacing old diesel electric plant. Supplies shipyard.
		612-4 10th Anniversary Shipyard 72/	IM	Diesel oil	1	Supplies shipyard.
		612-5 Stalin Ship Repair Yard 73/	IM	Oil	1	Supplies ship repair yard.
	Nizhniy Baskunchak 48°26'N - 46°50'E*	612-6 Municipal Power Plant 75/	MKK	Diesel oil (?)	1	
	Stepnoy 46°16'N - 44°14'E	612-7 Municipal Power Plant 76/	MKK	Oil	1	Actually located outside the Volga region.
Balashov Oblast	Balashov 51°32'N - 43°08'E	617-1 Municipal Power Plant 77/	MKK (?)	Coal	3	
	Bol'shaya Gribanovka 51°27'N - 41°58'E	617-2 Municipal Power Plant 78/	MKK (?)	Coal, oil (?)	1	
	Borisoglebsk 51°23'N - 42°06'E	617-3 Municipal Power Plant 79/	MKK (?)	Oil	3	
	Uryupinsk 50°48'N - 42°01'E	617-4 Municipal Power Plant 80/	MKK	Diesel oil	1	

* 74/

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Political Subdivision	Location and Coordinates	Plant Number and Identification	Subordination	Fuel	Installed Capacity (Thousand Kilowatts)	Remarks
Kuybyshev Oblast						
	Chapayevsk 52°58'N - 49°41'E	613-1 TETs at Explosives Combine No. 309 and No. 15 81/	IM	Shale	25	
		613-2 Southeast railroad station 82/	MKK (?)	Shale	6	
	Kuybyshev 53°12'N - 50°09'E	613-3 GRES, TETs 83/	MES	Coal (anthracite culm)	52	In operation in 1932 with 12,000 kw. Additional turbines of 3,000 kw, 12,000 kw, and 25,000 kw installed later. Supplies local industrial and municipal consumers and Chapayevsk.
		613-4 Bezymyanka TETs 84/	MES	Coal (anthracite culm)	100	Started in 1941 with a 25,000-kw turbine. Evidence of expansion in 1946-47. Planned to supply power for construction of Kuybyshev GES. Also supplies industrial consumers, including nearby aircraft factories.
		613-5 Municipal Power Plant 85/	MKK	Coal (?)	3	Old plant, probably used in emergency only.
		613-6 Lend-Lease No. 3 refinery 86/	IM	Oil	20	Completed in 1946 with US Lend-Lease equipment. 5,000-kw unit added in 1947 or later. Supplies oil refinery.
		613-7 Machinery Plant No. 42 imeni Maslenikov 87/	IM	Diesel oil	2	
		613-8 Novo-Kuybyshev TETs 88/	MES	Coal, natural gas	24	Molotov rayon of the city of Kuybyshev. Construction started in 1949; in operation in 1953.

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Political Subdivision	Location and Coordinates	Plant Number and Identification	Subordination	Fuel	Installed Capacity (Thousand Kilowatts)	Remarks
	Syzran' 53°11'N - 48°27'E	613-9 GRES, TETs 89/	MES	Shale	24	Under construction in 1939; began operations in January 1948; two 12,000-kilowatt turbines. Supplies Stalin refinery, other industries, and Kuybyshev GES construction. Connected to Kuybyshev power system.
		613-10 Batraki, in or near asphalt plant 90/	IM	Diesel oil	3	Supplies railroad facilities and asphalt plant.
		613-11 Kashperovka 91/	IM	Shale	8	Supplies Syzran' Shale Distilling Plant, Kashperovka.
		613-12 Municipal GES 92/	MKK	Hydro	2	Construction began in 1927; in operation in 1929; first GES in the Volga region. Located on Syzranka River.
		613-13 Auxiliary to Plant 613-12 93/	MKK	Diesel oil	1	Used only in emergency or during peak loads.
	Yablon'ka 53°25'N - 49°24'E*	613-14 Plant No. 1 94/	IM	Diesel oil	1	Supplies oil fields in area.
		613-15 Plant No. 3 95/	IM	Diesel oil	2	Supplies oil fields in area.
	Zol'noye 53°26'N - 49°48'E	613-16 96/	IM	Diesel oil	3	Supplies oil fields in area.
Saratov Oblast	Atkarsk 51°50'N - 40°00'E	614-1 Municipal Power Plant 97/	MKK	Diesel oil	1	

* See footnote on p. 36, above.

Political Subdivision	Location and Coordinates	Plant Number and Identification	Subordination	Fuel	Installed Capacity (Thousand Kilowatts)	Remarks
	Balakovo 52°03'N - 47°45'E	614-2 Dzerzhinskiy Machine Building Plant 98/	IM	Diesel oil	1	Supplies Dzerzhinskiy plant.
		614-3 Shipyard 99/	IM	Diesel oil	2	Supplies shipyard and town.
	Gornyy 51°47'N - 48°33'E	614-4 100/	IM (?)	Shale	10	Located 5 kilometers from Gornyy and 14 kilometers from Rukopol. Consumers not known. Estimate based on 1942 German aerial photograph.
	Marks 51°42'N - 46°46'E	614-5 Municipal Power Plant 101/	MKK	Probably diesel oil	1	
		614-6 Kommunist Diesel Engine Plant 102/	IM	Diesel oil	1	Supplies diesel engine plant.
	Ozinki 52°12'N - 48°26'E	614-7 Municipal Power Plant 103/	MKK (?)	Diesel oil (?)	3	In operation in 1940-41.
	Saratov 51°34'N - 46°02'E	614-8 GRES 1 104/	MES	Coal (anthracite culm), natural gas	73	In operation in 1930. Expanded in postwar period.
		614-9 TETs 105/	MES	Shale	37	In operation in 1934 with capacity of 12,000 kw. Planned to install a 25,000-kw turbine in 1939. Consumers include agricultural machinery (combine) and tractor parts plants.
		614-10 Tramway 106/	MKK	Coal	2	Supplies power to streetcar system in Saratov.

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Political Subdivision	Location and Coordinates	Plant Number and Identification	Subordination	Fuel	Installed Capacity (Thousand Kilowatts)	Remarks
		614-11 Municipal Power Plant 107/	MKK	Coal	2	
		614-12 Ball Bearing Plant No. 3 TETs 108/	IM	Coal	24	Under construction in 1940. First unit of 12,000 kw planned for 1941. Supplies bearing plant and other consumers.
		614-13 Krasnodar Refinery TETs 109/	IM	Oil, natural gas	24	Supplies power and steam to refinery.
		614-14 Engels Municipal Power Plant 110/	MKK	Coal	5	
	Savel'yevka 51°42'N - 48°32'E	614-15 Shale Extraction Plant 111/	IM	Shale	3	Under construction in 1937-38; may have expanded after the war. Supplies power to shale mining and extraction facilities in area.
	Vol'sk 52°03'N - 47°24'E	614-16 Bolshevik Cement Plant 112/	IM	Natural gas (?)	20	Small diesel electric plant also exists here. Supplies cement plant and other consumers in Vol'sk.
		614-17 Krasnyy Oktyabr Cement Plant 113/	IM	Natural gas, oil	2	Under construction in 1939; expanding in 1949.
Stalingrad Oblast	Frolovo 49°46'N - 43°38'E*	615-1 at Archeda Railroad Station 114/	MKK (?)	Diesel oil	2	Supplies railroad facilities and town.
	Kamyshin 50°06'N - 45°24'E	615-2 at glass works 115/	MKK	Coal	1	Supplies glass works and town.

* See footnote on p. 36, above.

Political Subdivision	Location and Coordinates	Plant Number and Identification	Subordination	Fuel	Installed Capacity (Thousand Kilowatts)	Remarks
	Kotel'nikovskiy 47°38'N - 43°12'E	615-3 Municipal Power Plant 116/	MKK (?)	Diesel oil	1	Supplies railroad repair shop and town.
	Stalingrad 48°45'N - 44°25'E	615-4 GRES Beketovka 117/	MES	Coal (anthracite culm)	200	In operation in 1930. Damaged during German invasion. Expanded in postwar period. Supplies industrial and municipal consumers and Stalingrad GES construction.
		615-5 Tractor Plant TETs 118/	IM (?)	Coal (anthracite culm) oil	50	Construction in 1932 with capacity of 12,000 kw, and increased to 19,000 kw by 1936. Damaged during the war. Operating at prewar capacity of 22,000 kw by 1944. Expanded in postwar period. Supplies tractor works and other local consumers.
		615-6 TETs (new) 119/	MES	Coal (?)	24	Planned new TETs in Balka Dubevaya section of Stalingrad in 1947; construction to start in 1948. It is assumed that construction was completed by 1954. 24,000 kw is a common minimum capacity rating of TETs and is used here as a best estimate, lacking firm data.

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Political Subdivision	Location and Coordinates	Plant Number and Identification	Subordination	Fuel	Installed Capacity (Thousand Kilowatts)	Remarks
	Stalingrad 48°45'N - 44°25'E	615-7 Red October Metallurgical Works 120/	IM	Coal, oil	24	Damaged during the war; reconstructed and expanded in postwar period. Supplies metallurgical plant.
		615-8 Red Barricade Armament Plant 121/	IM	Coal, oil	5	Damaged during the war; reconstructed and enlarged in 1949.
		615-9 Petrov Oil Equipment Plant 122/	IM	Coal	5	Under construction in 1948; in operation in 1954. Supplies Petrov Plant.
Ul'yanovsk Oblast						
	Sengiley 53°57'N - 48°47'E*	616-1 Probably at cement plant 123/	IM (?)	Diesel oil	3	Supplies cement plant and other consumers.
	Ul'yanovsk 54°20'N - 48°24'E	616-2 Motor Vehicle Plant TETs 124/	IM (?)	Coal	24	Started in January 1947. Supplies Motor Vehicle Plant and other consumers.
		616-3 Volodarskiy Ammunition Plant 125/	IM	Coal	20	Supplies Volodarskiy Plant and other consumers.
		616-4 Municipal Power Plant 126/	MKK	Coal (?)	5	
		616-5 Municipal Power Plant 127/	MKK	Diesel oil	1	
	Yazykovo 54°18'N - 47°24'E	616-6 Kalinin Textile Plant 128/	IM	Diesel oil (?)	1	Supplies textile plant.

* See footnote on p. 36, above.

2. Power Plants of Less Than 1,000 Kilowatts in the Volga Region of the USSR, January 1955.

Power plants having capacities estimated to be under 1,000 kw have been identified at the following locations as of January 1955. Sources for coordinates are the same as those of 1, above. In some cases the plant has only been identified as located in a political subdivision, and the exact coordinates are not available (N.A.).

Political Subdivision	Location and Coordinates
Tatar ASSR	Agryz 129/ 56°33'N - 53°02'E
	Alekseyevskoye 130/ 52°15'N - 46°20'E*
	Arsk 132/ 56°05'N - 49°53'E*
	Bondyuzhskiy 133/ 55°54'N - 52°20'E
	Bugul'ma 134/ 54°33'N - 52°45'E
	Buinsk 135/ 54°57'N - 48°17'E
	Kamskoye Ustye 136/ 55°11'N - 49°16'E*
	Kazan' 55°45'N - 49°08'E
	Textile Plant imeni Lenin 137/
	Vakhitovsky Soap and Chemical Factory 138/
	Felt Plant imeni Galationova 139/
	Shipyard imeni 25 October 140/
	Kukmor 141/ 56°11'N - 50°54'E
	Kuybyshev Zaton 142/ 55°04'N - 49°12'E
	Mamadysh 143/ 52°51'N - 45°50'E
	Naberezhnyye Chelny 144/ 55°42'N - 52°19'E
	Nurlat 145/ 54°26'N - 50°46'E
	Tetyushi 146/ 54°55'N - 48°50'E
	Yelabuga 147/ 55°45'N - 52°04'E
	Zelenodol'sk 148/ 55°50'N - 48°30'E
	at Agricultural Machinery Plant
Astrakhan' Oblast	Astrakhan' 46°21'N - 48°03'E
	Lenin Shipyard 149/
	Kirov and Engels Shipyard 150/
	Chernyy Yar 151/ (N.A.)
	Ikryanoye 152/ (N.A.)
	Kamyzyak 153/ 46°12'N - 48°05'E*

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Political Subdivision	Location and Coordinates
	Kapustin Yar 154/ 48°34'N - 45°45'E*
	Krasnyy Yar 155/ (N.A.)
	Lagan' 156/ 45°22'N - 47°24'E
	Liman 157/ 45°47'N - 47°10'E
	Marfino 158/ 46°23'N - 48°44'E
	Moguta 159/ (N.A.)
	Nikol'skoye 160/ 47°46'N - 46°24'E*
	Privolzhskiy 161/ 46°24'N - 48°00'E
	Sasykoli 162/ 47°34'N - 47°01'E
	Vladimirovka 163/ 48°18'N - 46°10'E
	Yenotayevka 164/ 47°15'N - 47°05'E
	Zelenga 165/ 46°11'N - 48°36'E
Balashov Oblast	Arkadak 166/ 51°57'N - 43°29'E*
	Povorino 167/ 51°11'N - 42°12'E
Kuybyshev Oblast	Alakayevka 168/ 53°25'N - 50°46'E*
	Aleksandrovka 169/ 53°21'N - 49°28'E*
	Al'kino 170/ 53°44'N - 52°14'E
	Appeltal 171/ 53°26'N - 49°23'E*
	Bakhilova Polyan 172/ 53°26'N - 49°40'E
	Bezenchuk 173/ 52°49'N - 49°26'E*
	Glushitskiy 174/ (N.A.)
	Khvorostyanka 175/ 52°36'N - 48°59'E
	Kinel' 176/ 53°14'N - 50°41'E
	Klimovka 177/ 53°30'N - 49°00'E*
	Kuybyshev 53°12'N - 50°09'E
	Ball Bearing Plant No. 9 178/
	Ball Bearing Plant No. 4 179/
	Aircraft Engine Plant imeni Frunze 24 180/
	Ship Repair Yard 181/
	Otvazhnoye 182/ (N.A.)
	Pravaya Volga 183/ 53°11'N - 48°47'E*
	Timashevo 184/ 53°22'N - 51°09'E
	Sugar Refinery
	Yablonka 185/ 53°25'N - 49°24'E*

* See footnote on p. 43, above.

Political Subdivision	Location and Coordinates
Saratov Oblast	Alekseyevskoye 186/ 52°15'N - 46°20'E* Balakovo 52°03'N - 47°45'E Municipal Power Plant 187/ Aircraft Engine Plant 188/ (N.A.) Balanda 189/ 51°30'N - 44°29'E* Bazarnyy Karabul 190/ 52°16'N - 46°25'E Dergachi 191/ 51°13'N - 48°46'E* Grimm 192/ 50°52'N - 45°30'E* Karabulak 193/ (N.A.) Khvalynsk 194/ 52°30'N - 48°05'E Khvatovka 195/ 52°23'N - 46°35'E Kologrigovka 196/ 51°44'N - 45°19'E* Krasnorchenski 197/ (N.A.) Novouzensk 198/ 50°28'N - 48°10'E Oktyabr'skiy 199/ 51°55'N - 50°08'E Petrovsk 200/ 52°20'N - 45°24'E Pugachev 52°02'N - 48°49'E Old Municipal Power Plant 201/ New Municipal Power Plant 202/ Saratov 51°34'N - 46°02'E Railroad Equipment Plant 203/ Oil Extraction Plant No. 1 204/ Aircraft Accessories Plant 306 205/ Aircraft Plant No. 292 206/ Engels Meat Combine 207/ Vol'sk 52°03'N - 47°24'E Kommunar' Cement Plant 208/
Stalingrad Oblast	Chernomorov 209/ 48°14'N - 43°28'E Dubovka 210/ 49°05'N - 44°52'E Kotluban' 211/ 48°56'N - 44°08'E

* See footnote on p. 43, above.

Political Subdivision	Location and Coordinates
	Nikolayevsk 212/ (N.A.)
	Stalingrad 48°45'N - 44°25'E
	Il'yich Bolt and Chain Plant 213/
	Osnovatel Mustard Oil Plant 214/
	Elektrales Wood Processing Plant 215/
	Soyuznefti Plant 216/
Ul'yanovsk Oblast	Barysh 217/ 53°40'N - 47°08'E
	Kanadey 218/ 53°10'N - 47°32'E
	Mayna 219/ 54°06'N - 47°39'E
	Melekess 54°15'N - 49°33'E
	Municipal Power Plant 220/
	Textile Mill 221/
	Flour Mill 222/
	Mullovka 223/ 54°12'N - 49°24'E
	Nikolayevka 224/ 53°08'N - 47°10'E
	Rumyantsevo 225/ 53°32'N - 46°59'E
	Staroye Timoshkino 226/ 53°44'N - 47°31'E*
	Staryy Salavan 227/ 54°21'N - 50°10'E

* See footnote on p. 43, above.

3. Distribution of Electric Power Plants in the Volga Region of the USSR, by Size and by Administrative Control, January 1955. a/

Table 9

Plants of 1,000 Kilowatts and More (Thousand Kilowatts)	Ministry of Electric Power Stations			Industrial Ministries			Ministry of Communal Economy			Ministry of Agriculture			Totals		
	Number of Plants	Capacity (Thousand Kilowatts)	Percent of Total Capacity b/	Number of Plants	Capacity (Thousand Kilowatts)	Percent of Total Capacity b/	Number of Plants	Capacity (Thousand Kilowatts)	Percent of Total Capacity b/	Number of Plants	Capacity (Thousand Kilowatts)	Percent of Total Capacity b/	Number of Plants	Capacity (Thousand Kilowatts)	Percent of Total Capacity b/
100 to 200	3	420	33										3	420	33
50 to 99	4	266	20	1	50	4							5	316	24
10 to 49	5	146	11	10	203	16							15	349	27
1 to 9				20	49	3	24	60	5				44	109	8
Subtotal	12	832	64	31	302	23	24	60	5				67	1,194	92
Plants under 1,000 kilowatts				49	25	2	49	25	2	2,000	60	4	2,098	110	8
Total	12	832	64	80	327	25	73	85	7	2,000	60	4	2,165	1,304	100

a. The absence of figures in any column in this table indicates zero.
b. Percentage figures have been rounded to nearest whole number.

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4. Electric Power Plants in the Volga Region of the USSR, by Type of Fuel Used, January 1955. a/

Table 10

Political Subdivision	Coal		Fuel Oil		Diesel Oil		Shale		Natural Gas	
	Capacity (Thousand Kilowatts)	Percent of Oblast Capacity b/	Capacity (Thousand Kilowatts)	Percent of Oblast Capacity b/	Capacity (Thousand Kilowatts)	Percent of Oblast Capacity b/	Capacity (Thousand Kilowatts)	Percent Oblast Capacity b/	Capacity (Thousand Kilowatts)	Percent of Oblast Capacity b/
Tatar ASSR	243	99	2	Negligible	1	Negligible				
Astrakhan' Oblast	81	93	2	2	4	5				
Balashov Oblast	4	50	3	37	1	13				
Kuybyshev Oblast	179	65	20	7	12	5	63	23		
Saratov Oblast	106	50	24	11	9	4	50	24	22	11
Stalingrad Oblast	309	99			3	1				
Ul'yanovsk Oblast	49	91			5	9				
Total c/	971	81	51	4	35	3	113	10	22	2

a. The absence of figures in any column in this table indicates zero.
b. Percentage figures have been rounded to nearest whole number.
c. Grand total, 1,192 million kw, does not include 2,000 kw in hydroelectric plants.

5. Transmission Lines (35 and 110 Kilovolts) in the Volga Region of the USSR, 1954.

Origin	Terminal	Remarks
Kazan' 228/	Zelenodol'sk	Length is about 44 km; supplies shipbuilding and other industries in Zelenodol'sk. Continues to Volzhsk in Region VII.
Urussu 229/	Bavly	Supplies Tuymazy oil fields; continues to Oktoberstadt in Region VIII.
Kuybyshev 230/	Syzran'	Connects Syzran' and Batraki to Kuybyshev power system.
Kuybyshev 231/	Komsomol'sk	Connects Kuybyshev system to Kuybyshev GES construction site and to petroleum enterprises in Stavropol' area. Probably was in operation in 1951; length is 100 km.
Kuybyshev 232/	Chapayevsk	Connects Chapayevsk to Kuybyshev power system.
Syzran' 233/	Zhigulevsk	Supplies Kuybyshev GES construction site and oil fields in area. Probably in operation in 1951.
Saratov 234/	Vol'sk	Supplies cement and other industries in Vol'sk.
Saratov 235/	Marks	Length is 50 km; line was in operation in 1935. Supplies machine building plants in Marks and other consumers.
Stalingrad 236/ (Beketovka GRES)	Verkhnyaya Akhtuba (Stalingrad GES construction site)	Connects Beketovka GRES with the metallurgical works and the tractor plant and runs north to the Stalingrad GES construction site.
Stalingrad 237/ (Beketovka GRES)	Krasnoarmeysk	Connects Krasnoarmeysk with the Stalingrad power system.
Stalingrad 238/ (Beketovka GRES)	Pumping stations along Volga-Don Canal	In operation in 1952. Supplies three pumping stations along Volga-Don Canal. Possibly extends as far as Tsimlyanskiy.

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6. Major Transmission Lines Under Construction or Planned in the Volga Region of the USSR, 1955.

Origin	Terminal	Voltage (Kilovolts)	Remarks
Kuybyshev GES 239/	Moscow	400	Under construction; planned to be in operation by the end of 1955. 900-km double-circuit; will transmit 1.2 million kw to Moscow area.
Kuybyshev GES 240/	Ufa	220 or 400	Not confirmed; however, this is the logical connecting link to the Urals network.
Kuybyshev GES 241/	Saratov	220	Under construction; probably will connect with city of Kuybyshev.
Saratov 242/	Astrakhan'	220	Planned extension of the Kuybyshev-Saratov line, above; will connect Saratov, Stalingrad, and Astrakhan'.
Stalingrad GES 243/	Moscow	400	Planned, possibly under construction. Planned to be in operation by the end of 1956 but will probably not be in operation until 1957 or 1958.
Stalingrad 244/	Tsimlyanskiy	220 or 400	Planned. Line would probably be extended to connect with Dnepr-Donets network.

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7. Basic Data on the Kuybyshev and Stalingrad Hydroelectric Stations.

a. Kuybyshev GES.

(1) Location.

The dam was planned originally to be located at Krasnaya Glinka, just north of Kuybyshev. Postwar plans relocated it further upstream at Zhigulevsk, 75 km northwest of Kuybyshev. The new towns of Komsomol'sk and Novyy Stavropol' have risen near the left bank construction area, Zhigulevsk being on the right bank.

(2) Generating Equipment.

There are twenty 105,000-kw units (water turbine and generator) 245/ which are comparable to the nineteen 108,000-kw units at Grand Coulee in the US. The generators are from the Elektrosila plant, and the water turbines are from the Leningrad Metal Works (LMZ), both in Leningrad. The first turbine was reportedly completed in March 1954 246/ and the ninth, in March 1955. 247/ The first generator was reportedly completed in January 1954 248/ and the seventh, by the end of 1954. 249/

(3) Construction.

Construction of the Kuybyshev GES, started in 1950 under the supervision of I. Komzin, is estimated to require the following 250/:

Concrete, 5 million to 7 million cubic meters.
Earthwork, 165 million to 200 million cubic meters.
Lumber, over 2 million cubic meters.
Cement, over 2 million tons.
Metal, 700,000 tons.
Stone and ballast, over 12 million cubic meters.

Although it was originally planned to complete construction and installation of equipment by the end of 1955, an analysis of construction progress up to September 1954 showed that this was impossible and that the best that could be attained would be partial operation in 1955. 251/ The Russians have since announced that only two units would be operating by the end of 1955. 252/

The total length of the concrete cross-river structure, including dam, spillways, power house, and locks, is nearly 6 kilometers, a tremendous span. 253/ The reservoir formed by this dam will be 500 km long, equivalent to the distance from Washington to Cleveland, and will cover an area of 5,000 square kilometers, 254/ almost equal to the area of the State of Delaware. The final closing of the dam structure will take place in August 1955, when filling of the 19.5-cubic-kilometer reservoir will begin. 255/ Operation of the first two generating units will begin in the last quarter of 1955, probably in December.

b. Stalingrad GES.

(1) Location.

Originally the proposed site was near Kamyshin, 150 km upstream from Stalingrad. Postwar plans relocated it further downstream, near the town of Volzhsk on the northern outskirts of Stalingrad.

(2) Generating Equipment.

There are seventeen 105,000-kw units. Generators and turbines will be produced by the Elektrosila and LMZ plants in Leningrad and are similar, if not identical, to those produced for the Kuybyshev GES. None of these units is yet reported as being in process of manufacture.

(3) Construction.

Construction of the Stalingrad GES started in 1951, and operation at full capacity was planned for 1956. F.G. Loginov was originally appointed Chief of Stalingradgidrostroy, but in 1954 he left to become Minister of Construction of Electric Power Stations. 256/ Over 110 million cubic meters of earthwork and 6 million cubic meters of concrete are involved in the project. The dam will be 5 kilometers long and 45 meters high, backing up a reservoir extending as far as Syzran', a distance of over 500 kilometers.

APPENDIX B

CALCULATION OF FUEL REQUIREMENTS FOR THE PRODUCTION OF ELECTRIC POWER IN THE VOLGA REGION OF THE USSR, 1954

Table 11 a/

Fuel	Installed Capacity (Thousand Kilowatts)	Estimated Production b/ (Million Kilowatt-Hours)	Heating Value c/ (Kilocalories per Kilogram)	Fuel Rate d/ (Kilograms per Kilowatt-Hours)	Fuel Requirements e/ (Thousand Metric Tons)	Estimated Margin of Error (Percent)
Coal	971	4,370	5,400	0.65	2,840	-20 to + 5
Oil shale	113	510	1,500	2.33	1,200	-20 to + 5
Residual fuel oil	51	230	9,370	0.37	90	- 5 to +25
Diesel fuel oil	35	160	10,000	0.35	60	- 5 to +25
Natural gas	22	100	8,530	0.41	40	- 5 to +50

a. Including only thermal electric power plants 1,000 kw and over.
b. Calculated by multiplying capacity in kilowatts by 4,500 hours of utilization.
c. From a 1953 Soviet handbook. 257/
d. Determined by the following formula:

Fuel rate = $\frac{a}{b}$ (c)

Where a = Heating value of "standard" fuel (7,000 kilocalories per kilowatt-hour)
b = Heating value of actual fuel
c = Soviet 1954 "standard" fuel rate in MES stations (0.5 kilograms per kilowatt-hour) 258/

For example, oil shale, $\frac{7,000}{1,500} \times 0.5 = 2.33$

e. Calculated by multiplying production in kilowatt-hours by the fuel rate in kilograms per kilowatt-hour and converting to tons. Totals rounded to nearest 10,000 tons.

APPENDIX C

METHODOLOGY

Little information was available about the postwar capacity of power plants. Estimates were made on the basis of prewar capacity figures, which were usually available, plus analysis of fragmentary information concerning the plant's expansion in the postwar period. In some cases, estimates were made from such information as aerial photographs, number of smokestacks or cooling towers, and other fragmentary data.

Methodology for derivation of total installed capacity, production, consumption, and fuel requirements is given in the text and in footnotes to tables.

APPENDIX D

GAPS IN INTELLIGENCE

Information about prewar electric power facilities in the Volga Region is generally adequate, but there is less information available on the postwar period (1946-50). There are many gaps in intelligence on the 1950-54 period and on plans for the future.

Information is lacking on the growth of generating facilities from 1950 to 1954. Capacity data on the following existing power plants is particularly needed: the Stalingrad GRES, the Gornyy Thermal Power Plant, the Novo-Kuybyshev TETs, the Urussu GRES, the Kazan' TETs No. 2, and the new TETs in Stalingrad.

Plans for construction of thermal electric power plants from 1955 to 1962 have not been found. Specific dates on which the various units at Kuybyshev and Stalingrad will be placed in full operation are unavailable; also, Soviet estimates as to when either or both of these plants will be operating at full capacity.

Information is lacking on power production either by individual power plants, for cities, or for the region as a whole. Average annual hours of utilization or the average load for power plants in the 1950-54 period, and Plan figures for 1955 to 1962 are also unavailable.

Information is lacking on consumption by industrial enterprises in the region -- especially oil refineries, the Stalingrad aluminum plant now under construction, and machine building enterprises.

Information is lacking on plans for the proposed Stalingrad-Tsimlyanskiy and Stalingrad-Moscow transmission lines, on plans for transmitting power to the Urals, and on the terminals of the line.

Information is also lacking on the extent of the consumption of natural gas and residual fuel oil in power plants.

APPENDIX E

SOURCE REFERENCES

The major sources of information for this report included Soviet newspapers, periodicals, and books; prisoner-of-war interrogation reports; and monitored Soviet radio broadcasts.

Soviet newspapers and periodicals, most of which antedate 1950, furnished the greater part of the material used. Elektricheskiye stantsii, a Soviet technical journal and organ of the Ministry of Electric Power Stations, was the most valuable source of information on the period from 1929 to the present. Pravda, Izvestiya, and other Russian language material were also used.

Data on many small power plants were found only in prewar publications. The two main sources were Bol'shoy sovetskiy atlas mira (Great Soviet Atlas of the World), Vol. 2, Moscow, 1939, and Spisok promyshlennykh predpriyatiy k atlasu "Promyshlennost' SSSR na nachalo 2-oy pyatiletki" (List of Industrial Enterprises Included in the Atlas "Industry of the USSR at the Beginning of the Second Five Year Plan"), Moscow, 1934.

Prisoner-of-war interrogation reports were an important source of information on the 1944-50 period, although the data derived from them were often contradictory and unreliable.

Reports based on monitored Soviet radio broadcasts contributed a portion of the scant information on the years since 1950.

25X1C

[redacted]

Evaluations, following the classification entry and designated "Eval.," have the following significance:

Source of Information	Information
Doc. - Documentary	1 - Confirmed by other sources
A - Completely reliable	2 - Probably true
B - Usually reliable	3 - Possibly true
C - Fairly reliable	4 - Doubtful
D - Not usually reliable	5 - Probably false
E - Not reliable	6 - Cannot be judged
F - Cannot be judged	

"Documentary" refers to original documents of foreign governments and organizations; copies or translations of such documents by a staff officer; or information extracted from such documents by a staff officer, all of which may carry the field evaluation "Documentary."

Evaluations not otherwise designated are those appearing on the cited document; those designated "RR" are by the author of this report. No "RR" evaluation is given when the author agrees with the evaluation on the cited document.

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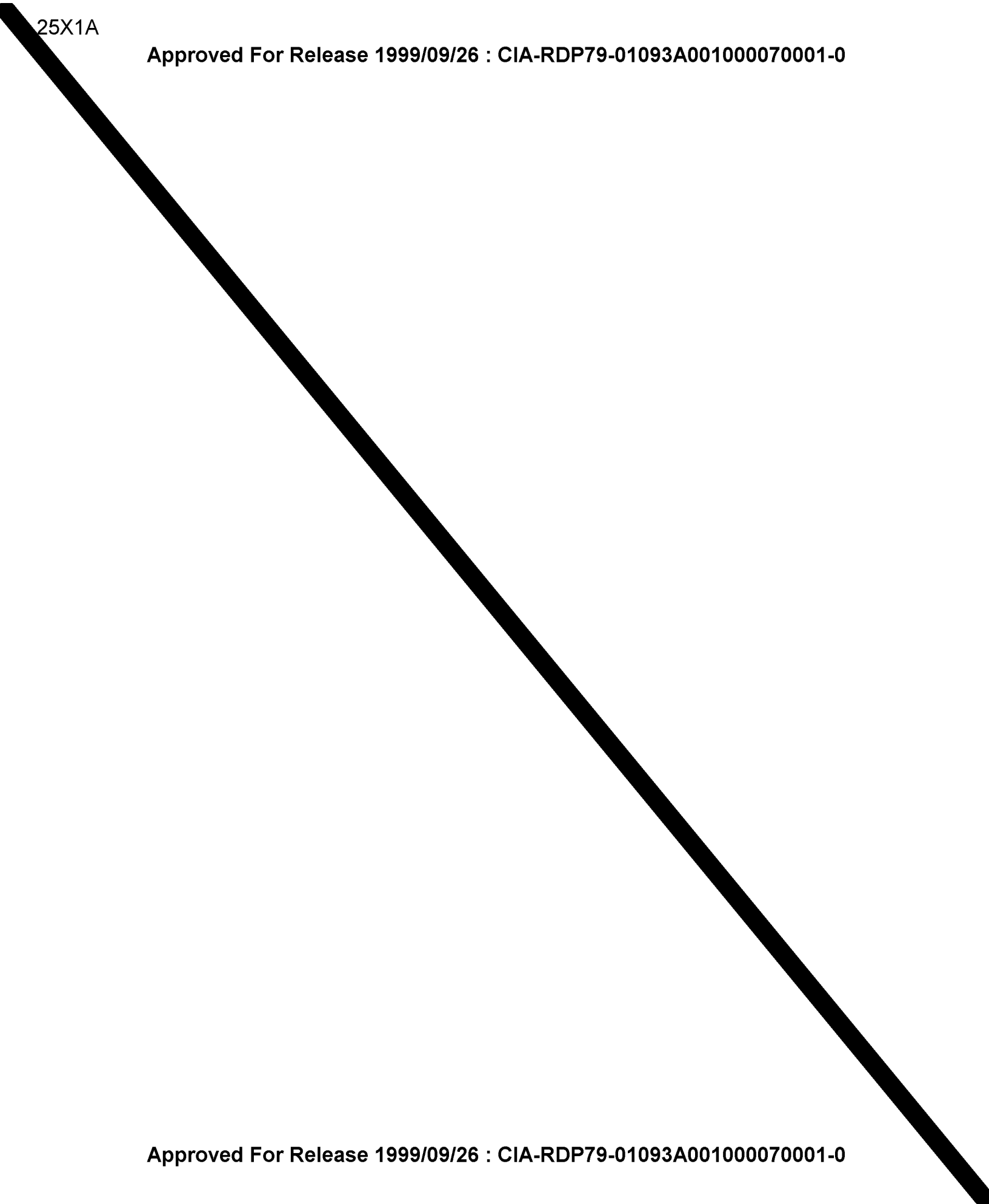

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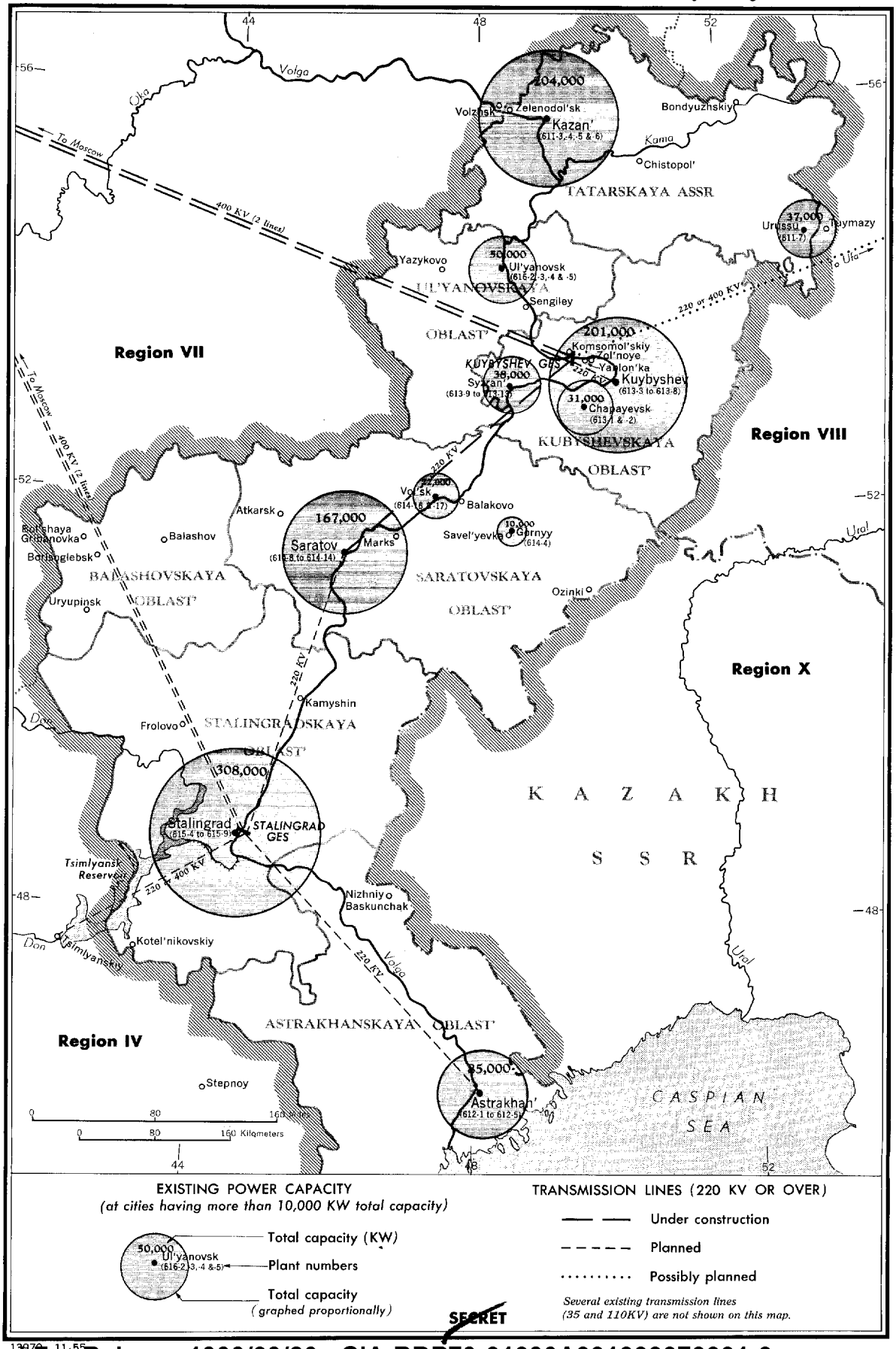

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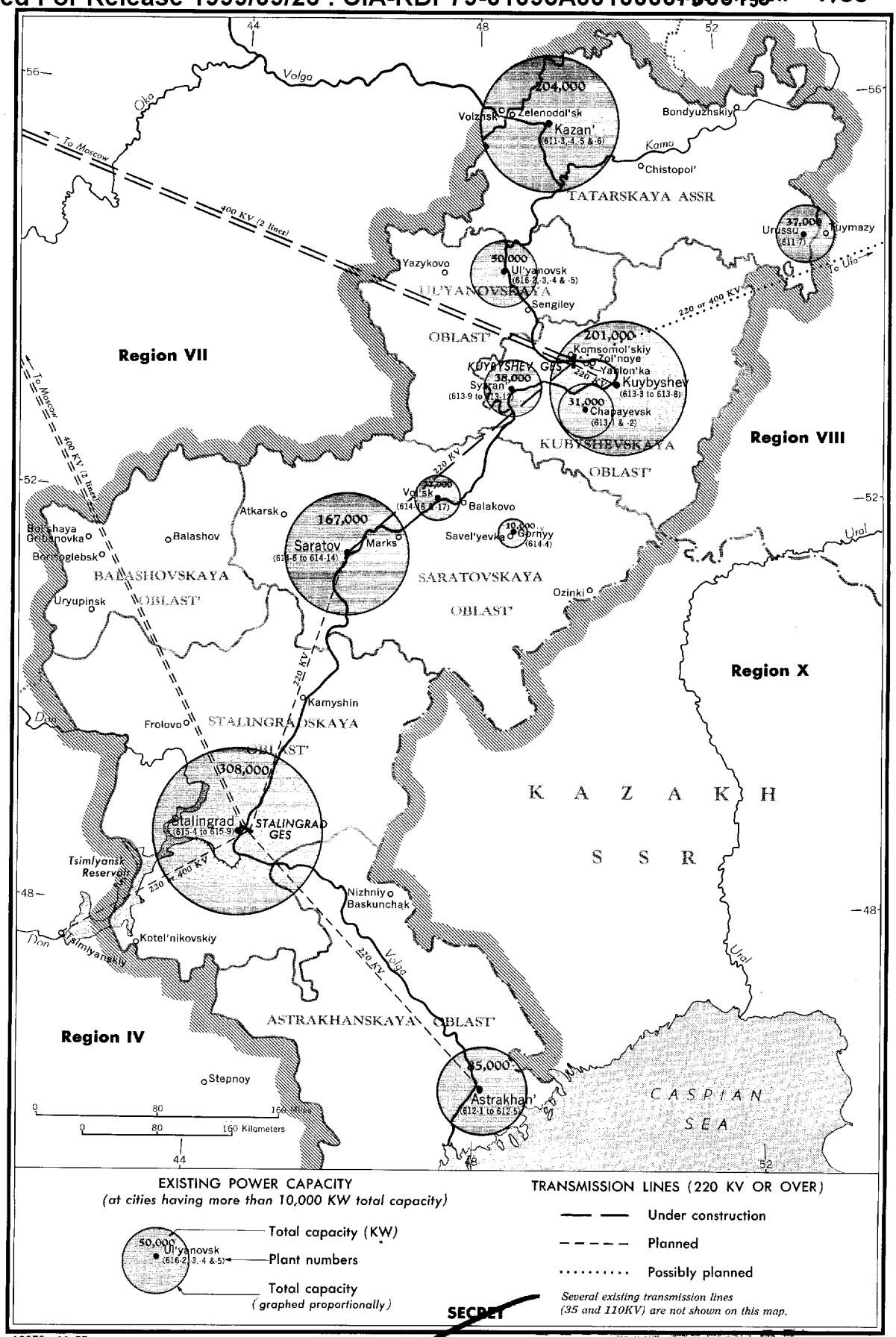

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