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PROVISIONAL INTELLIGENCE REPORT

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ELECTRIC POWER IN POLAND



CIA/RR PR-117

29 July 1955

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ELECTRIC POWER IN POLAND*

Summary

The industrial economy of Poland is centered around the coal mining, metallurgical, and chemical industries, all of which are large consumers of electric power. It is estimated that in 1955 these industries will consume about 66 percent of the total industrial consumption of electricity in Poland. Because there is no economically feasible substitute for electricity, it is evident that the electric power industry is now, and will continue to be, of major importance in the industrial expansion of Poland.

Poland is the second largest producer of electric power in the European Satellites, outranked only by East Germany, and its share of the total electric power production in the European Satellites and in the Sino-Soviet Bloc has steadily increased since 1946. It is estimated that in 1955 the production of electric power in Poland will be 23 percent of the total European Satellite production and 7 percent of the total Sino-Soviet Bloc production. Analysis of estimates of electric power production in 1955 for Poland, the USSR, and the US indicates that the production of 17.4 billion kilowatt-hours (kwh) in Poland will be 11 percent of Soviet and 3 percent of US production.

The substantial gains made and expected to be made by the industry are reflected in the announced production for 1954 (15.4 billion kwh) and in the estimated production for 1955 (17.4 billion kwh) and 1960 (32.3 billion kwh), which are, respectively, more than twofold and nearly fourfold that of 1949 (8.3 billion kwh).

The electric power potential in Poland, in terms of coal resources, is extremely large. Coal reserves in Poland are immense and will provide an ample supply for many hundreds of years. Expansion of facilities for the production of electric power, however, is limited

* The estimates and conclusions contained in this report represent the best judgment of ORR as of 15 May 1955.

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by dependence upon foreign technology, material, and equipment; Poland is capable of producing less than 20 percent of its requirements for heavy electrical machinery, and the industry will be dependent upon foreign sources for technical engineering aid for some years to come.

Although it is possible that changes in the consumption of electric power might be an indicator of intentions, the changes are too slow to be used as definite indicators and must be used in conjunction with other more substantial indicators -- which can usually support themselves.

I. Introduction.

A. General.

As considered in this report, the electric power industry of Poland includes the generation, transmission, and distribution of electric power for and to the ultimate consumers. The physical facilities involved include all public utility power plants (municipal and regional) and all industrial power plants, except for small, miscellaneous plants used for emergency purposes, and all transmission and distribution facilities. Although in Poland the Ministry of Power (Ministerstwo Energetyki) is responsible for the production of power-generating equipment (boilers, turbines, generators, transformers, and auxiliary machinery), this segment is not included in this report. Reference is made to the supply of this equipment only as it affects the planned expansion program of the industry.

The time period covered by this report is the postwar period (1946-60) with only brief reference to the war and prewar periods for historical and comparative purposes.

Present-day Poland is defined as the area within the postwar boundaries -- between the Oder-Neisse Rivers on the west and the Curzon Line on the east. Except for reference to historical data and background, this is the area covered in the report.

Electric power is a keystone of modern industrial economy. The economical development and expansion of practically all industries

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depend upon the supply of electricity for motive power and electro-technical processes. Many specialized industries and processes have no substitute for electric power -- for instance, various chemical and metallurgical reduction operations. The mining of coal, previously accomplished by manual, compressed air, or steam-driven operation, is now done faster and more economically with electrically powered tools. Haulage of coal in the mines, previously performed by manpower or horsepower, is now done with electric locomotives. The commercial production of aluminum is not possible without electric power, and the production of zinc and many ferrous alloys can be accomplished more economically in electric furnaces.

B. Boundary Changes.

The boundary changes which took place in 1945 greatly increased the scope of the Polish economy. Although the westward shift resulted in an ultimate loss of approximately 30,000 square miles of territory, all of the eastern area, ceded to the USSR, was agrarian. The western area, on the other hand, was highly industrialized and was particularly rich in coal resources. As a result of the boundary changes, there was a gain of about 50 percent in the electrical generating capacity. ¹/_{*} The loss of electric power facilities in the east was insignificant compared with the gain in the west.

II. Organization and Administrative Structure.

After the end of hostilities in 1945 an organization was established to control the power economy of Poland. It was called the Central Administration for Power (Central Zarzadz Energetyki -- CZE). ²/ _{During 1952 and 1953, marked changes were made in the organizational structure.** They seem to reflect the importance which Poland attached to the electric power industry and the resultant desire to place all elements of the industry under a single control. To this end the Ministry of Power was established, and the Central Administration for Power, formerly subordinate to the Ministry of Heavy Industry, became subordinate to the Ministry of Power. The Central Administration for Power was strengthened to the extent of putting all industrial power plants under its complete control and retaining control of the public utilities. The}

* For serially numbered source references, see Appendix D.

** For an organization chart, see Figure 1, following p. 4.

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Ministry of Power was further enlarged by subordination of the Central Administration for the Power Generating Industry (Centralny Zarzod Przemyslu Energetycznego -- CZPE), formerly under the control of the Ministry of the Machine Industry.* 4/

Included in the changes was a regrouping of the former 13 power regions into 6 power districts,** which generally conformed to geographic areas rather than to county boundaries. These districts, since 1951, are as follows 5/:

<u>District</u>	<u>Designation</u>
I	Central
II	Eastern
III	Southern
IV	Lower Silesia
V	Western
VI	Northern

III. Generation and Transmission Facilities.

A. Natural Resources.

1. Coal.

Coal, the principal natural resource in Poland and a mainstay of the national economy, is in virtually unlimited reserves. For the most part, it is of excellent quality for steam-producing purposes. Over 90 percent of the electric power plants are coal-fired.***

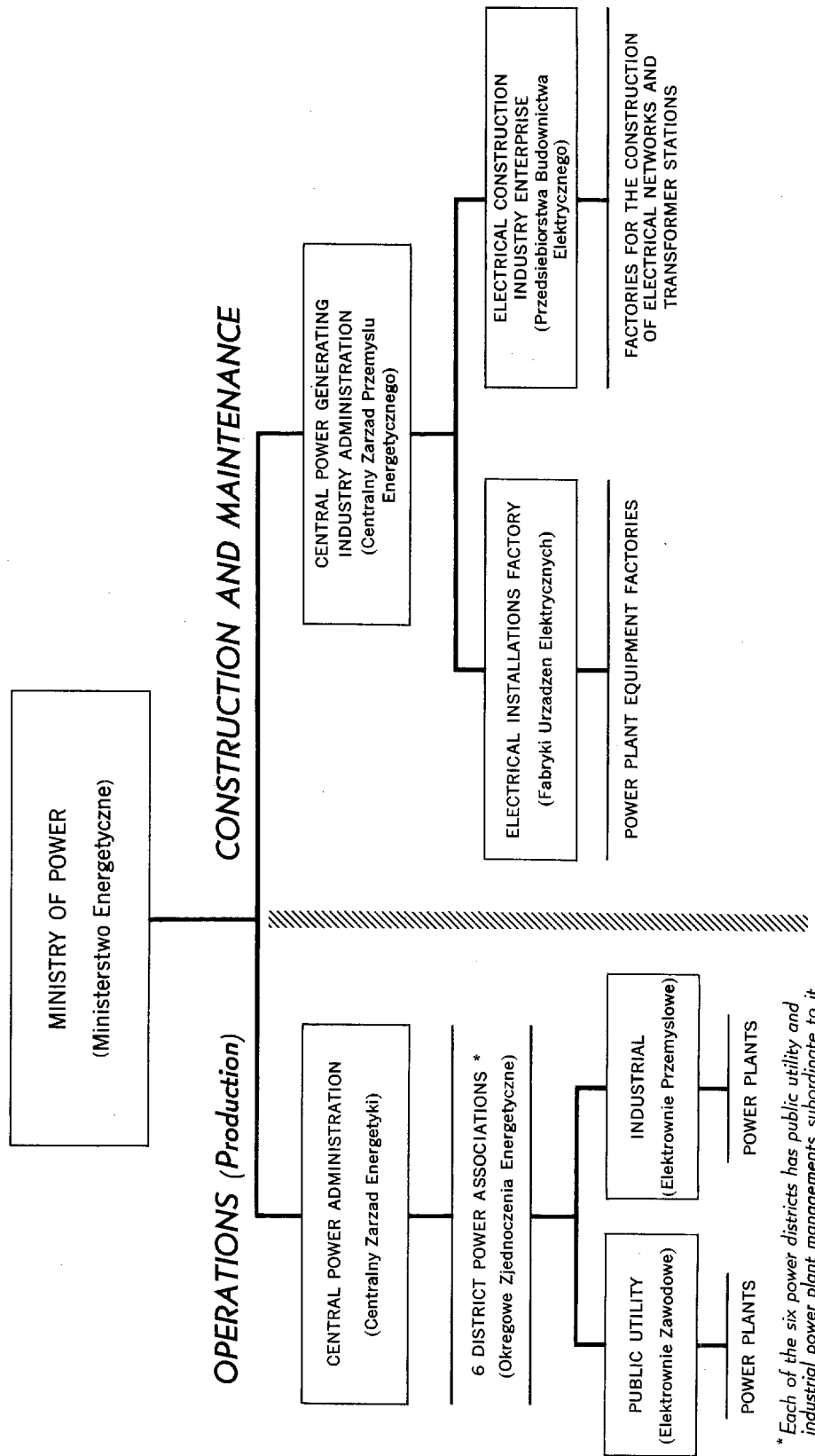
* The administrative chain of command is shown in Figure 1, 3/ following p. 4.

** For the district division of the electric system, see Figure 2, following p. 6.

*** For a documented breakdown of thermal electric plants and hydro-electric plants, see Appendix A.

Figure 1

POLAND ORGANIZATION OF THE ELECTRIC POWER INDUSTRY



* Each of the six power districts has public utility and industrial power plant managements subordinate to it.

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The abundance and availability of high-grade hard coal,* which can be burned more easily and effectively than brown coal, accounts for the fact that hard coal is used predominantly in thermal electric power plants. Because there are regions where brown coal is readily available, however, thermal electric power plants are being built or planned for burning this low-grade coal exclusively. This permits the conservation of hard coal, not only for other important requirements but also for export. Coal exports yield a major part of the income from foreign trade. There is a power plant planned at Turossow, the largest brown coal producing area in Poland, and another is under construction at Konin, which is just now being developed into a major brown coal mining operation.** Because coal reserves are abundant in Poland, fuel supplies will not be a limiting factor in planned expansion of thermal electric power production.

2. Water Power.

The potential resources of hydroelectric power in Poland are limited. There are several large rivers, but the predominantly flat terrain is a hindrance to economic development of hydroelectric power sites. The technically developable hydroelectric power resources amount to 3.65 million kilowatts (kw) of which approximately two-thirds are in the Vistula Basin, including the Bug River, and the remainder are in the Oder Basin. 6/ Only 0.6 million kw (approximately one-sixth of the technically developable resources) are considered economically exploitable. This, therefore, places a limit on the production of hydroelectric power, whereas there is no such limitation on thermal electric power.

Poland is planning large-scale developments of hydroelectric power on the Bug and Vistula Rivers during the next Plan period (1956-60). Polish scientists and engineers are reported 7/ to have worked out hydrotechnical construction plans for the

* The term hard coal in the European sense includes all grades of coal which in US terminology would be called anthracite or bituminous coal. Because there is no anthracite coal in Poland, the term, as used in this report, includes only the various grades of bituminous coal indigenous to Poland. The term brown coal in European terminology includes all grades of brown coal and lignite.

** For a documented breakdown of thermal electric plants and hydroelectric plants, see Appendix A.

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Vistula River, and it is also reported ^{8/} that similar developments on the Bug River will be started within the Six Year Plan (1950-55) and be continued into the next Plan period. The main purposes of these developments, however, are irrigation, flood control, and navigation. As a result of the development of streams for these purposes, a limited amount of hydroelectric capacity will become available. Although such plants have been mentioned for both the Vistula and Bug, no information on their projected size is available. This expansion will only slightly change the balance between hydroelectric and thermal electric plants. Hydroelectric power plant capacity was approximately 5 percent of the total in 1946, ^{9/} rising to 6 percent in 1950, and it is estimated that it will be about 8 percent in 1955.*

B. Electric Generating Plants.

As a result of occupation by the USSR and the Germans and of the devastating effects of physical damage and destruction from military actions, output by the electric power industry of Poland was at a low level at the end of World War II. It is believed that the majority of losses caused by damage and wear were restored by the end of 1949, although a considerable portion of the total loss was not restored -- that which the USSR dismantled and shipped to the USSR.

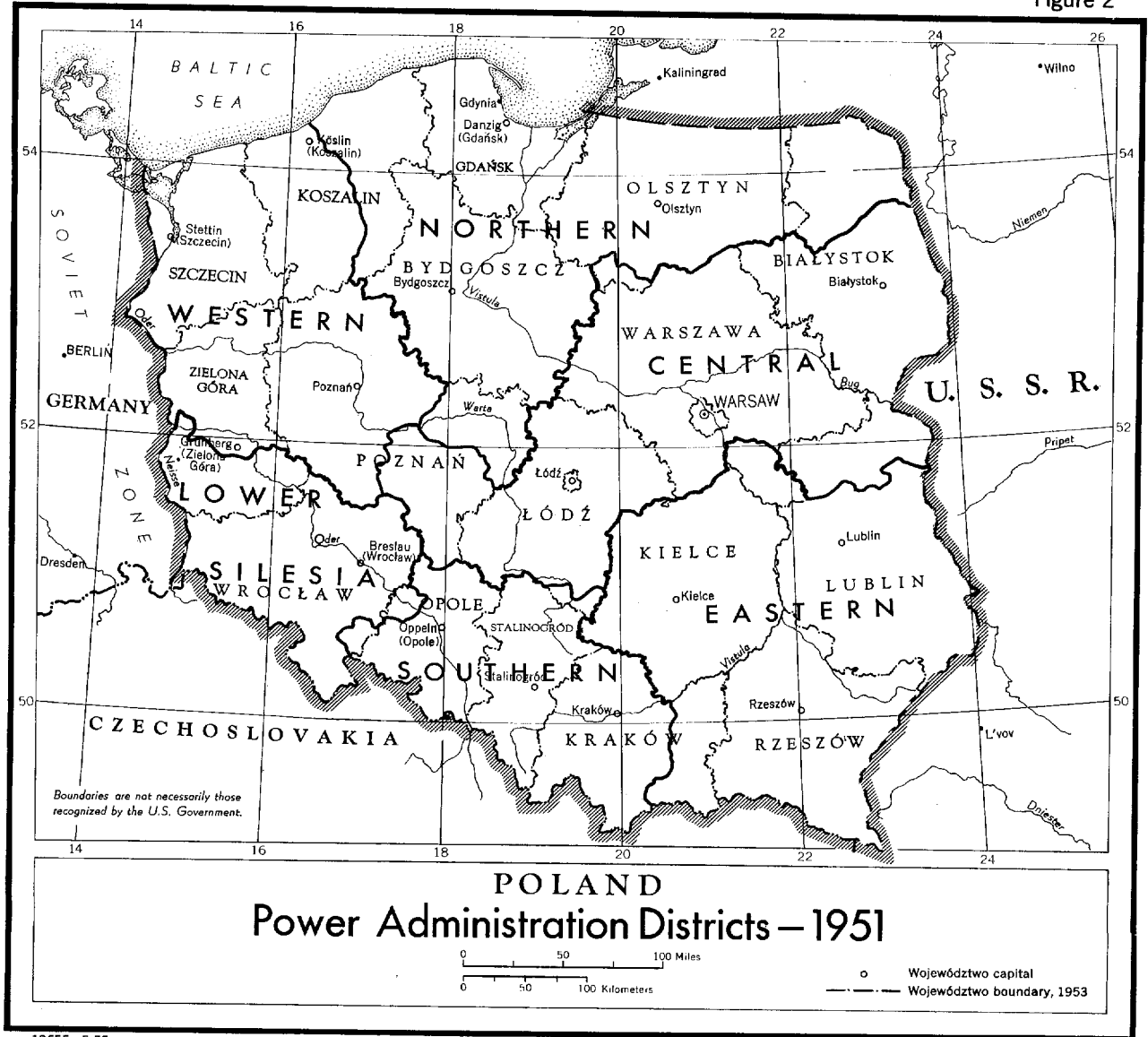
For the 10-year postwar period (1946-55) the growth of generating facilities has been steady and substantial. By the end of 1955 the estimated installed capacity (5.38 million kw) will be about two and one-half times that of 1946 (2.14 million kw), and three-fourths of this increase will have been accomplished during the Six Year Plan.

Because this 6-year period includes so large a part of the improved situation on installed capacity, attention is called to figures on this subject** which indicate the developmental trends occurring in the facilities of generating plants. A comparison of 1955 with 1950 shows that although the number of plants of over 5,000-kw capacity will not have increased materially (123 plants in 1950, 137 plants in 1955), the installed capacity of these plants

* Estimates are based on thermal electric and hydroelectric capacities in 1946 and on figures shown in Table 6, Appendix A.

** For plant capacity figures, see Table 6 Summary, p. 35, below.

Figure 2



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(2.39 million kw in 1950, 4.60 million kw in 1955) will have practically doubled. From this comparison, it is obvious that the trend is toward large units and large plants.* The trend is illustrated in the following tabulation in which the percentages are computed from capacity figures**:

<u>Plant Capacity</u>	<u>Percentage of Total Installed Capacity</u>	
	<u>1950</u>	<u>1955</u>
100,000 kw and over	13	34
50,000 to 100,000 kw	18	22
5,000 to 50,000 kw	49	30
Under 5,000 kw	20	14
	31	56
	69	44

The installed capacity of electric power plants in Poland during the 1946-55 period is shown in Table 1.***

The Six Year Plan (1950-55) calls for an increase in capacity of 2.62 million kw 10/ by the end of 1955. On the basis of annual increases in capacity, it appears that the Plan goal will barely be reached, and there are no indications that there will be an overfulfillment. The estimated increase of about 2.6 million kw during the Six Year Plan results in an average annual increase of 11.6 percent, which is slightly under the Soviet average of 11.8 percent 11/ during the Fifth Five Year Plan (1951-55). There are no indications of the target for electric power capacity in the next Plan period. The demand for electric power, however, will certainly continue upward, and because the rate of capacity increase in the Six Year Plan was realistic, it seems reasonable to assume the same rate of increase for the next Plan period. The estimated installed capacity of

* For a more detailed discussion of this trend, see V, below.
 ** For plant capacity figures, see Table 6, Appendix A.
 *** Table 1 follows on p. 9.

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electric power plants in Poland during the 1956-60 period is shown in the following tabulation*:

	<u>Million Kilowatts</u>				
	<u>1956</u>	<u>1957</u>	<u>1958</u>	<u>1959</u>	<u>1960</u>
Installed capacity	6.00	6.70	7.48	8.35	9.32
Annual increase	0.62	0.70	0.78	0.87	0.97

It is doubtful whether the achievement of an average 13.7-percent increase during the last 2 years of the Plan (1954 and 1955) will be continued, because this is believed to be a concentrated effort to fulfill the Plan. This does indicate a maximum possible achievement, however; so the range of error on the predicted annual capacities can be considered as from plus 10 percent to minus 5 percent.

C. Transmission Lines and Substations.

Through the acquisition of the facilities in the regained territory, the transmission system grew to 1,370 miles -- 2,203 kilometers (km) -- by 1949 and has since been expanded into a national network. It has been reported that by the end of 1952, 2,380 miles (3,833 km) of high-tension lines** had been installed and that by 1955 there would be 4,180 miles (6,725 km) of high-tension lines in operation. ^{12/} The fulfillment of this goal will more than triple the length of the network in the Six Year Plan.***

There are only two known major international exchange points, both of them crossing into Czechoslovakia. One is a 110-kv line from the Victoria power plant in Walbrzych through Porici to the

* Based on the assumption that the rate of capacity increase for 1956-60 will be the same as that for 1950-55.

** The term high-tension lines is used to designate lines of more than 100 kilovolts (kv) -- 110- , 150- , and 220-kv lines.

*** The national network of transmission lines as they existed at the end of 1954 is shown on the map, Figure 5, inside back cover. It is possible that some of the lines shown in operation are not yet completed and that some of the lines shown as under construction have been placed in operation.

Table 1
 Installed Capacity of Electric Power Plants in Poland. a/
 1946-55

	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955
Installed capacity	2.141 <u>13/</u>	2.284 <u>14/</u>	2.456 <u>15/</u>	2.786 <u>16/</u>	2.970 <u>17/</u>	3.280 <u>b/</u>	3.690 <u>b/</u>	4.160 <u>b/</u>	4.730 <u>b/</u>	5.380 <u>b/</u>
Annual increase	0.143	0.172	0.330	0.184	0.310	0.470	0.410	0.570	0.570	0.650
Aggregate increase during the Six Year Plan				0.184	0.494	1.374	0.904	1.944	2.594	

a. The figures for 1946-48 are from the official Polish statistics, which state that they are for plants of 1,000 kw and over. There is an estimated total capacity of 100,000 to 160,000 kw in small plants (under 1,000 kw) which is not included in these figures. It has been impossible to determine definitely whether the figures for 1949-50 contain this additional capacity, but it is assumed that they do, in the light of the abnormal difference between the 1948 and 1949 capacities. On the basis of this assumption it is estimated that the capacities given for the years 1951 through 1955 depict the total installed generating capacity of all plants in Poland.

b. Derived from figures given in Table 6, Appendix A. For methodology, see Appendix B.

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Czechoslovak industrial centers of Kolin and Pardubice with a capability of approximately 200 million kwh annually. The other is a 220-kv line under construction from the Dwory power plant through Ostrava to Telnice. This line will eventually be part of an international network connecting Poland, Czechoslovakia, Austria, and possibly Hungary. 18/

Before 1945 there were seven 110-kv lines crossing the Oder-Neisse line into East Germany, but it is believed that all of these were dismantled by the USSR and that no replacements have been made. 19/ Exchange of electric power with East Germany is accomplished with a variety of lines of less than 100 kv. There are no transmission lines of greater than 100 kv crossing into the USSR and only very few lines of less than 100 kv.

There are major transmission substations at all of the power plants connected to the national network, often as integral parts of the power plants themselves. In addition, there are other substations at interconnection points where there is a change in transmission voltage.

D. Existing Concentrations.

The major power-producing area in Poland is the southern industrial region. In 1946 it contained 69 percent of the total installed capacity and produced 77 percent of the total output. This area is generally confined to the 1951 Power Districts III and IV. The next largest concentration is in central Poland (the Lodz-Warsaw area), containing 14 percent of the total installed capacity and producing 11 percent of the total output. This area is composed of the 1951 Power District I. Finally, the western section contains 12 percent of the total installed capacity and produces 9 percent of the total output. This area is located in the 1951 Power Districts V and VI. 20/

The coal basin will continue to be the major power-producing area, as in the past, but the central and western sectors will probably increase their shares of the total capacity and output through the construction of such large plants as the Zeran heat and power plant and the Mlociny power plant in Warsaw, the Lodz heat and power plant, and the Ostroleka power plant and by the reconstruction of the Pommerensdorf power plant in Szczecin (Stettin).* It is doubtful

* For documentation for these plants, see Appendix A.

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that capacity and production in the coal basin will ever drop below 50 percent of the national totals.

The main concentration in the coal basin is in the Zabrze-Chorzow-Stalinogrod-Jaworzno area, adjacent to the old Polish-German border. This area contains approximately 40 percent of the total installed capacity (60 percent of the coal basin capacity) and produces approximately 55 percent of the total output (70 percent of the coal basin output).

IV. Production and Consumption.

A. Available Supply.

1. Production.

Yearly increases in the production of electric power were accomplished during the Three Year Plan (1947-49). This was primarily a period of readjustment, but it provided a guide for establishing the projected accomplishments of the Six Year Plan, under which the Polish planners established a goal of 18 billion kwh for 1955 (see Figure 3*). This target was raised to 19.3 billion kwh almost immediately after its announcement, reportedly at Soviet insistence. 21/

That the original goal is more realistic than the revision is apparently indicated by reported production figures for 1950 and 1953, the first and fourth years of the Plan. These figures show an average annual rate of increase of 13.2 percent, only a little lower than the 13.8 percent required to meet the original target, whereas the revised target would require a rate of 15.1 percent.

In January 1955, Boleslaw Bierut, First Secretary of the Central Committee, stated that electric power production in 1954 was 13 percent greater than in 1953. 22/ If that rate should continue through 1955, the result would be an underfulfillment of the original goal of about 3 percent, an amount so inconsequential that it may be said that the original target was realistic and virtually fulfilled. The production of electric power in Poland during the 1946-55 period is shown in Table 2.**

* Following p. 12.

** Table 2 follows on p. 12.

Table 2
Production of Electric Power in Poland
1946-55

	Three Year Plan						Six Year Plan					
	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955		
Planned production	6.80 a/	7.40 a/	8.40 a/	8.80 b/	10.0 b/	11.6 b/	13.5 b/	15.6 b/	18.0 b/	(19.3) c/		
Achieved production d/	5.71 e/	6.61 f/	7.51 f/	9.41 h/	10.7 i/	12.0 j/	13.6 g/	15.4 k/	17.4 l/	-0.60		
Variation from plan m/	-0.19	+0.11	-0.10	+0.61	+0.70	+0.40	+0.10	-0.20				

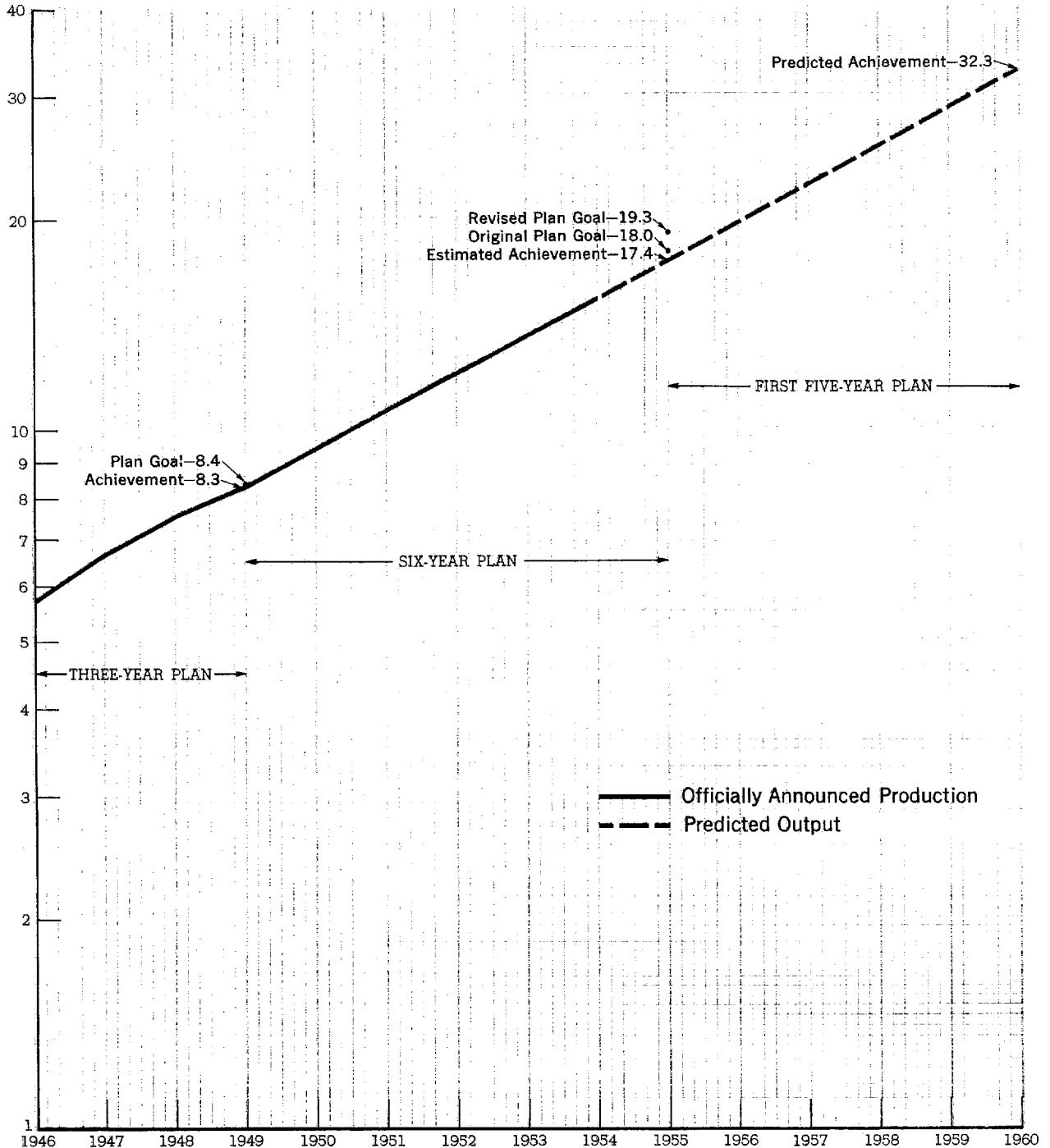
a. 3/3
b. 4/4
c. Revised plan goal. 25/
d. Figures for 1950 are official. Figures for from 1951 through 1954 are computed from announced percentage increases over previous year and therefore are possibly subject to slight variation. The estimated 1955 figure is subject to a range of error of from plus 4 percent to minus 2 percent.
e. 6/6
f. 7/7
g. 8/8
h. 9/9
i. 10/10
j. 11/11
k. 12/12
l. Extrapolated from the production curve in Figure 3, following p. 12.
m. Minus sign for below Plan and plus sign for above Plan.

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Figure 3

POLAND ELECTRIC POWER PRODUCTION

(Billions of KWH)



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The next Plan will probably be for a 5-year period to coincide with the Soviet Sixth Five Year Plan as well as with the expected Five Year Plans of other European Satellites. ^{33/} The estimated production of electric power in Poland during the 1956-60 period is as follows*:

<u>Billion Kilowatt-Hours</u>				
<u>1956</u>	<u>1957</u>	<u>1958</u>	<u>1959</u>	<u>1960</u>
19.7	22.3	25.2	28.5	32.3

2. Exports and Imports.

Exports and imports of electric power by Poland do not materially affect the available domestic supply because the net interchange -- the difference between the amounts exported and imported -- is very small. The difference is estimated at less than 1 percent of the national production. Data on the net interchange for selected years during the 1946-53 period are as follows:

<u>Million Kilowatt-Hours</u>						
	<u>1946</u>	<u>1947</u>	<u>1949</u>	<u>1950</u>	<u>1952</u>	<u>1953</u>
Net exports						
from Poland						
to Czechoslovakia	91 <u>34/</u>	80 <u>35/</u>	110 <u>36/</u>	110 <u>37/</u>	100 <u>38/</u>	143 <u>39/</u>
Net imports						
to Poland						
from East Germany	40 <u>40/</u>	N.A.	100 <u>41/</u>	130 <u>42/</u>	N.A.	N.A.

Because the figures shown represent the net interchange, they do not reflect the total amounts of power which may flow in each direction. Even though the net interchange is but a small part of the

* Based on the average annual rate of increase derived from the achieved production for the Six Year Plan, 13.2 percent. This estimate should be within a range of error of plus 10 percent and minus 5 percent.

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national production, it is important to the supplies of certain vicinities and permits the international exchange of power in times of temporary emergency and for efficient loading of the larger plants involved.

The interchanges are confined to the immediate neighbors of Poland, the USSR, Czechoslovakia, and East Germany. Little is known about the interchange with the USSR, but it is certain to be small because there are no known high-tension lines capable of transmitting large quantities of power, and there are few lower voltage lines. Similarly, there appear to be no major transmission lines between Poland and East Germany, but a number of lower voltage, small-capacity lines permit enough interchange so that net imports into Poland from East Germany are about equal to exports from Poland to Czechoslovakia. It is probable that the interchange with Czechoslovakia will increase, not only by means of the existing high-tension line from Walbrzych into northwestern Czechoslovakia but also because of the completion of the 220-kv line from the jointly financed Czechoslovak-Polish plant at Dwory connecting with the Czechoslovak system at Ostrava and running from there into central Czechoslovakia.

B. Consumption.

1. Pattern.

Although information is not available in sufficient quantity to construct annual consumption patterns for the principal categories of users of electric power in Poland, it is doubtful that the pattern for 1946 and that planned for 1955 will change drastically during the next Plan period. The pattern of electric power consumption in Poland in 1946 and 1955 is shown in Table 3.*

The consumption pattern indicates that industry is by far the largest consumer of electric power. In 1946 the largest single industrial consumer was the coal mining industry, which used approximately 42 percent of the total industrial consumption, followed by the metallurgical and chemical industries, which used approximately 15 percent and 13 percent, respectively. ^{43/} This balance will be radically changed in 1955, when the planned consumption will be as follows: metallurgical, 25 percent; chemical, 23 percent; and coal mining, 18 percent. ^{44/}

* Table 3 follows on p. 15.

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Table 3

Pattern of Electric Power Consumption in Poland a/
1946 and 1955

<u>Consumer</u>	<u>Percent</u>	
	<u>1946 <u>b/</u></u>	<u>1955 <u>c/</u></u>
Industry	87.0	80.8
Domestic (street lighting, commercial, residential)	9.7	12.2
Agriculture	0.9	2.5
Exports	2.1	1.9
Traction (railroad electrification)	0.3	2.6
Total	<u>100.0</u>	<u>100.0</u>

a. Given in terms of the percent of the gross production less system loss and plant use, which accounts for 22.6 percent of the gross production in 1946 and 19.6 percent in 1955.

b. Based on source 45/.

c. Interpolated from source 46/.

This radical change of the consumption pattern within the industrial category can best be explained by the rapid growth in the metallurgical and chemical industries. The long-established coal industry has advanced at a much slower rate; its 1955 power consumption, however, will be 34 percent greater than in 1946. The increased use of electric power in the metallurgical and chemical industries in this same period is illustrated by the fact that estimated 1955 tonnages of a selected list of their important products requiring large amounts of electric power indicate outputs between 3 and 4 times 1946 tonnages, and the estimated electric power consumptions by these industries -- based on the planned percentages indicated in the preceding paragraph -- will be nearly 5 times those of 1946. The apparent discrepancy between the increase in tonnage and the amount of power consumed, even after allowance for products not included on the list, can best be explained by the fact that greater uses are being made of electric power, particularly in the

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way of electric drives, electric-arc furnaces, and electrochemical processes.

The per capita consumption in Poland can be used for a valid comparison with per capita consumption of other countries to indicate the relative availability of electric power. In 1955 the per capita consumption in Poland will be about the same as that in the USSR but only about 40 percent of that in East Germany. The estimated per capita consumption of electric power in Poland during the 1946-55 period is as follows:

<u>Kilowatt-Hours per Person</u>																
<u>1946</u>	<u>1947</u>	<u>1948</u>	<u>1949</u>	<u>1950</u>	<u>1951</u>	<u>1952</u>	<u>1953</u>	<u>1954</u>	<u>1955</u>							
242	<u>47/</u>	275	<u>48/</u>	315	<u>49/</u>	339	<u>50/</u>	370*	430*	500	<u>51/</u>	530	<u>52/</u>	600*	682	<u>53/</u>

2. Controls and Restrictions.

The domestic consumption of electricity in Poland is under very rigid controls, especially during the winter months, the time of highest peak loads. For example, during the winter of 1953-54, restrictions were placed on the number and size of light bulbs that could be used in all establishments, including factories, hospitals, and public buildings as well as residences. 54/ In December 1953, residential consumers were restricted in the use of electric cookers, irons, heaters, and the like between the peak load hours of 1600 to 2200. 55/

Although in February 1954 the Ministry of Power issued a directive "considerably increasing the supplies of electric power for individual consumers," 56/ restrictions were again placed on all consumers in August for the coming winter (1954-55). 57/ It is easy to see that although great strides are being made in increasing production and that the basic needs of industry are being met, demand is still ahead of supply, and the domestic consumers are made to suffer the shortages.

* Calculation based on total production (see Table 2, p. 12, above) and population figures.

S-E-C-R-E-TV. Growth.A. General.

In recent years the trend in Poland has been toward electric power plants having large generating capacity and serving a relatively wide area, as opposed to the earlier practice of smaller plants serving only their immediate environs. Obviously, plants of greater capacity could be provided simply by increasing the number of generating units of the sizes formerly used, but the tendency has been to accomplish increased capacity through the use of much larger individual units.

This trend toward larger plants and larger units conforms to modern practice in the electric power industry because it leads in most instances to increased plant efficiency, reduction in plant labor force per kw of capacity, and lower investment costs per kw. These benefits usually will more than offset increased transmission losses.

A few of the plants are "heat and power stations" in which the steam passes through the turbines to generate power and then is used for central heating. Examples are the Zeran and Mlociny plants in Warsaw and the new Lodz power plant. The trend toward larger equipment can be seen in the following statistics on the average electric power plant* in Poland in selected years during the 1949-55 period 58/:

	<u>1949</u>	<u>1952</u>	<u>1953</u>	<u>1955</u>
Turbine capacity (1,000 kw)	7.5	9.0	10.7	12.4
Boiler output (metric tons per hour)	19.1	24.1	29.3	37.0
Boiler pressure (pounds per square inch)	375	503	613	750
Coal consumption (kg per kwh)	0.796	0.709	0.660	0.580

Although it is proposed that equipment planned for new power plants will include boilers of capacities up to 230 tons per hour and turbines of capacities up to 50,000 kw, 59/ there is no indication

* The average of power plants of capacities of 1,000 kw and greater.

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that this has been accomplished so far. The generating unit that is generally being used is of 25,000-kw capacity.

B. Increases in Facilities.

1. New Plants and Transmission Facilities.

Poland's Six Year Plan (1950-55) requires the construction of 14 new thermal and about 20 new hydroelectric power plants ^{60/} and the installation of about 4,500 km of high-tension transmission lines. ^{61/}

The most important thermal plants are Konin; Jaworzno II; Miechowice, in Chorzow; and Zeran, in Warsaw. Latest plans for these plants provide for an installed capacity of 300,000 kw in each, ^{62/} but it is doubtful that any of them will reach their full capacity by the end of the Plan period. This doubt is based mainly upon the fact that the capacities contemplated at the initiation of the Plan were revised upward, even as late as mid-1954, in order to attain an ultimate capacity of 300,000 kw.

There are only three major hydroelectric plants under construction: Dychow, at Bobrowice; Czorsztyn; and Dynow. These 3 plants will have installed capacities of 100,000 kw, 70,000 kw, and 40,000 kw, respectively.*

The most important accomplishment in the way of transmission facilities is the 220-kv network from the coal basin to Lodz and Warsaw. There are several 110-kv transmission lines under construction either to connect new plants to the system, to expand the existing network, or to strengthen weak sections of the system.**

2. Enlargement of Existing Facilities.

There are only 4 large power plants -- 2 industrial plants and 2 public utility plants -- that are known to have been expanded during the Six Year Plan, thus increasing their aggregate capacity from 370,000 kw to 585,000 kw. They are the Slazel Municipal and Chemical Power Plants in Chorzow, the Victoria Coal Mine power plant in Walbrzych,

* For documentation, see Appendix A.

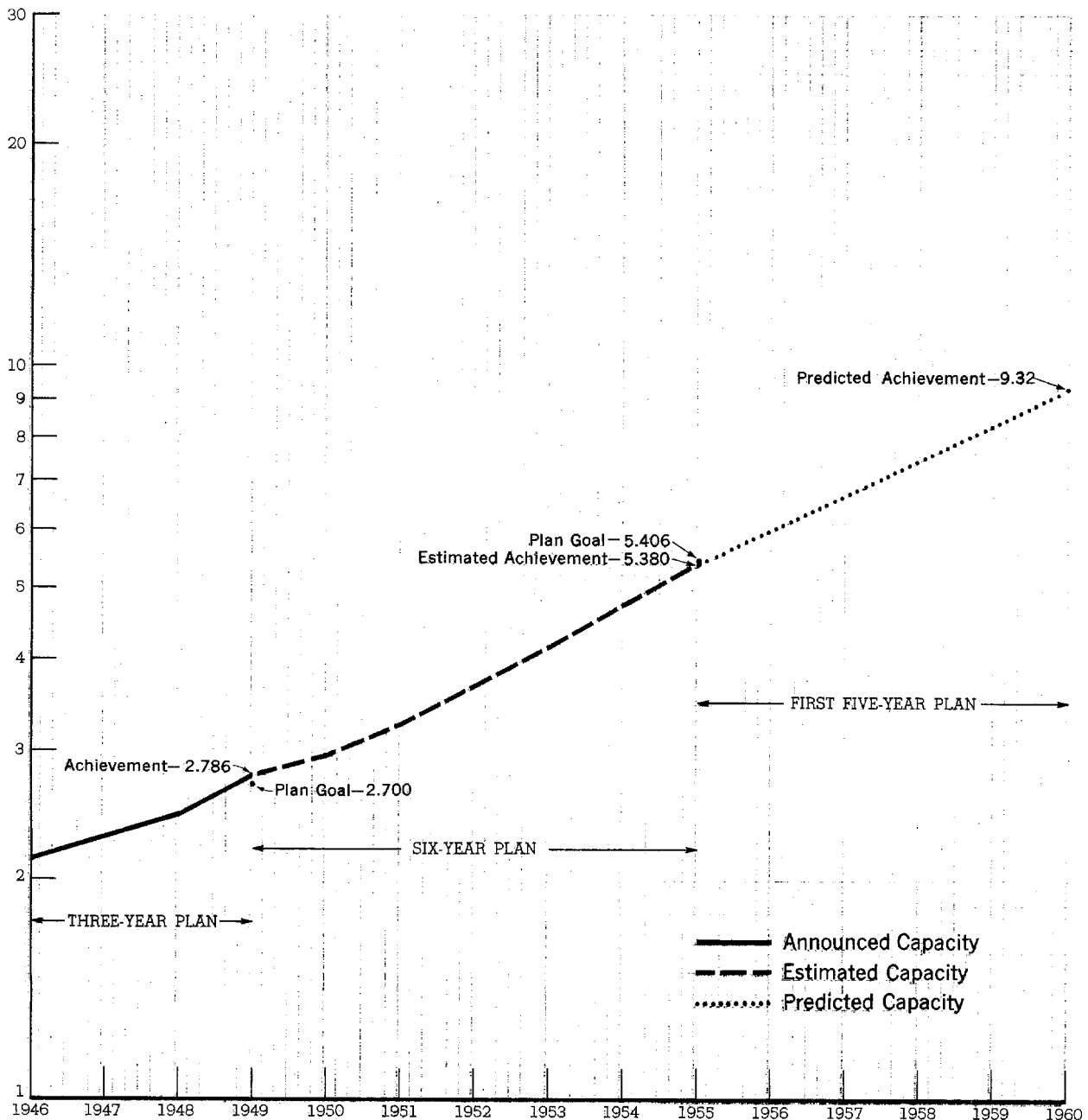
** For these transmission lines, see the map, Figure 5, inside back cover.

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Figure 4

POLAND ELECTRIC GENERATING PLANT CAPACITY

(Total Installed Capacity, In Millions of KW)



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and the Elektro Municipal Power Plant in Warsaw. There are 7 medium-size plants (Bydgoszcz, Czestochowa, Gdynia I and II, Poznan, Stalowa Wola, and Szopienice) that have been expanded to an installed capacity between 20,000 and 75,000 kw, thus increasing their aggregate capacity from 171,200 kw to 316,200 kw.* As far as small power plants (between 1,000 kw and 10,000 kw) are concerned, there is no indication of any expansion, the emphasis naturally being on the larger, more efficient power plants.

C. Deterrents to Growth.

Many factors hinder the expansion of electric power facilities in Poland; among them are shortages of domestically manufactured electrical equipment and of qualified technical personnel. Much in the way of technical aid, replacement parts, and complete equipment is being received from East Germany and the USSR. Czechoslovakia and France are instrumental in supplying transformers, turbines, and other heavy equipment. Poland has only recently been able to produce small, medium-pressure boilers 63/ and 25,000-kw turbines. 64/

D. Estimates of Growth through 1960.

Provided that the rate of growth during the Six Year Plan (1950-55) continues through 1960, there will be an increase in capacity of 3.94 million kw** during the expected Polish First Five Year Plan. Available information has generally failed to pinpoint the locations of planned or proposed power plants and to state accurately the installed capacity of these plants, but it is believed that approximately 25 percent of the increase in capacity will be located in the following plants already planned or under construction: the Bug I, Bug II, and Smukala hydroelectric power plants; the Lodz and Mlociny (in a suburb of Warsaw) heat and power plants; and the Pommerensdorf (in Szczecin), the Turoszow, and the Stalowa Wola thermal power plants.***

It is safe to assume that the high-tension network will continue to expand to provide extension of lines to areas not yet covered, connection of new power plants to the existing networks, and increase in capacity of existing lines by enlarging the size of

* For the locations and sizes of these plants, see Appendix A.

** For the extrapolated curve from which these data were taken, see Figure 4, following p. 18.

*** For location and documentation, see Appendix A.

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conductors or by adding more circuits on existing routes.* Information has not been released on growth of the network in the next Plan period, and estimates cannot reasonably be made by comparison with growth of capacity or increase in production. Therefore, no definite quantitative measurement of the network can be predicted for 1960.

VI. Input Requirements.

In terms of cost the two largest inputs to the production of electric power are fuel and labor. There are no data available to show a breakdown of costs in Poland, but US statistics 65/ reveal that the cost of production in thermal electric plants is divided as follows: 74 percent for fuel, 15 percent for labor, and 11 percent for maintenance and miscellaneous. Because thermal electric plants comprise approximately 92 percent of the total installed capacity in Poland, the major fuel to be considered here is coal, and it can be assumed that coal costs are the largest operating costs in the Polish electric power industry.

A. Fuels and Supplies.

The consumption of coal in thermal electric power plants in Poland amounted to 7.5 million metric tons 66/ in 1949. This was 9.5 percent of the total coal production and 17.6 percent of the domestic coal consumption for that year. It is estimated, on the basis of an increase of from 15.4 percent in 1949 to 21.2 percent in 1955 in power plant thermal efficiency, 67/ that in 1955 the coal consumption will have increased to 11.1 million metric tons, or 11 percent of the total coal production. The steady increase in thermal efficiency because of the installation of modern, efficient equipment will result in a reduction of the average fuel consumption.** A reliable source 68/ states that average fuel consumption was reduced from 0.796 kg per kwh in 1949 to 0.709 kg per kwh in 1952, and the Plan calls for a reduction to 0.580 kg per kwh by 1955. 69/

If the figure 0.58 kg per kwh is reached, it would have real significance, because, in effect, it would mean that the 1955

* For known planned transmission lines, see the map, Figure 5, inside back cover.

** Average fuel consumption is based on a standard fuel having a calorific value of 7,000 kilocalories per kilogram.

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electric power production would be produced with 4.2 million metric tons less coal than would have been required to produce the same output in 1949. This saving may not actually materialize; the theoretical saving is based on the assumption that the same grades of coal were used in both years, an assumption which may not be correct. The comparison serves to illustrate, however, that the saving will be of importance not only to the coal and electric power industries but also to the national economy as a whole.

As has been stated previously, hard coal is used predominantly in the thermal electric plants, having a ratio of approximately 18 to 1 over the use of brown coal in 1949. ^{70/} It is estimated that the ratio will be reduced to approximately 10 to 1 in 1955 through the operation of new thermal plants burning brown coal exclusively.

Supplies required in the generation of electric power include such expendable items as chemical water softeners, lubricating oils and greases, small tools, and recording graphs and charts. This equipment comprises only a very small percentage of the total operating expenses and presents no serious supply problem.

B. Manpower.

Statistics on the employment in the electric power industry in Poland are scarce and conflicting in nature, mainly because none of the sources reports the statistics in the same manner. A recent source ^{71/} states that power plant employees in public utility plants averaged almost 9 workers per 1,000 kw of installed capacity in 1949, with the expectation that this figure will be reduced to about 6 workers per 1,000 kw in 1955. This results in an employment of approximately 12,600 workers in 1949 and 22,400 in 1955* for plant operation in public utility power plants only. As far as total employment is concerned, a publication of 1947 gives the breakdown between operational and administrative personnel for the production and transmission-distribution of electric power in public utility and industrial plants. Employment in the electric power industry in Poland in June 1947 is shown in Table 4.** Estimated total employment in the electric power industry in Poland during the 1946-55 period is shown in Table 5.**

* Based on total estimated installed capacity in public utility plants.

** Tables 4 and 5 follow on p. 22.

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Table 4

Employment in the Electric Power Industry in Poland 72/
June 1947

	Public Utility			Industrial			Total		
	Opera- tional	Adminis- tration	Total	Opera- tional	Adminis- tration	Total	Opera- tional	Adminis- tration	Total
Power Plants	9.9	5.2	15.1	5.1	0.3	5.4	15.0	5.5	20.5
Network	3.7	2.3	6.0	1.2	0.1	1.3	4.9	2.4	7.3
Total	13.6	7.5	21.1	6.3	0.4	6.7	19.9	7.9	27.8

Table 5

Estimated Total Employment in the Electric Power Industry in Poland a/
1946-55

	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955
Total number of workers	27,000	29,000	31,000	34,000	36,000	39,000	43,000	47,000	51,000	55,000
Percent of total nonagricultural labor force	0.93	0.91	0.89	0.88	0.79	0.79	0.81	0.84	0.86	0.90
Percent of total population	0.11	0.12	0.13	0.14	0.14	0.15	0.17	0.18	0.20	0.21

a. For methodology, see Appendix B.

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The estimated employment shown in Table 5 is confirmed by the total employment shown in Table 4. These figures are within a reasonable range of the Plan figures of 28,000, 30,000, 35,000 and 38,000 for the years 1946 to 1949 73/ and the target of 53,000 planned for 1955. 74/

The electric power industry in Poland requires a very small segment (less than 1 percent) of the total nonagricultural labor force. Improved labor productivity in the electric power industry is reflected by the fact that, based upon the above estimates, electric power production amounted to 244,000 kwh per employee in 1949, whereas it will be 316,000 kwh per employee in 1955.

VII. Capabilities, Vulnerabilities, and Intentions.

A. Capabilities.

The capability of an electric power industry is dependent not only upon the capacity of its generating and transmission facilities but also on the fullest possible use of those facilities. Poland appears to have made substantial progress in both of these elements and is expected to continue to do so.

If the Polish generating facilities are increased at the same rate during 1956-60 as they were during the Six Year Plan, the result will be a 73-percent increase in 1960 over 1955. It is estimated, however, that in the same period electric power production will increase by 86 percent. This apparent discrepancy in the rate of growth will be largely the result of a fuller and more effective use of the means of production.

In this report, statements on capacity refer to installed capacity, which means the aggregate of the full rated capacity of all electric generators. This capacity is not a true measure of capability; the installed capacity cannot be fully operated at all times. The condition of equipment, the lack of adequate steam as a result of antiquated boiler equipment, down-periods for repair, and other operating conditions account for the difference between operable capacity and rated capacity.

It is reported that for all of the public utility plants in Poland in 1949 the operable capacity was 72 percent of installed capacity and that it is expected to increase to 93 percent in 1955. 75/

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If these percentages are applied to capacity figures for 1949 and 1955 (see Table 1*), they will show a nonoperable capacity of 780,000 kw and 377,000 kw, respectively. Therefore, if the plan is attained, it will mean the equivalent of about 400,000 kw added to operable capacity merely by putting presently deficient components of the generating facilities into full operation by means of repair and replacement, which can be done at a much smaller investment of time and money than would be required for the equivalent in new facilities.

B. Vulnerabilities.

At present, Poland is almost entirely dependent upon other countries, both inside and outside of the Soviet Bloc, for the supply of medium and large electrical equipment such as generators, turbines, boilers, transformers, and switchgear. If the supply of this equipment were cut off, the expansion of the electric power industry of Poland most certainly would be drastically retarded, and the economic stability of the country would be seriously affected.

It is estimated that, at the present, Poland is capable of building annually only 15,000 kw in generator capacity, less than 3 percent of the estimated capacity installed in 1954. It is doubtful that the electric equipment industry in Poland will be able to supply the country with more than 20 percent of the estimated capacity to be installed in 1960. For many years, therefore, Poland will be largely dependent upon the countries that produce heavy electrical equipment. Recent trade agreements with France and West Germany will materially aid the Polish electric power industry in its expansion program. 76/

The expansion of and planning for electric power facilities in Poland are dependent upon external sources for technical engineering aid. This will continue to be a deterrent to the electric power economy.

C. Intentions.

The electric power industry, when measured by changes in national capacity and production or by changes in consumption pattern, is not considered a good indicator of governmental intentions

* P. 9, above.

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regarding war or preparation for it. Such changes are too slow in development to act as indicators. Furthermore, because electric power enters so broadly into every phase of the national economy, it becomes an indicator of intentions only when its use can be pinpointed to a purpose obviously connected with the production of war materiel or the furtherance of war purposes. It is true that planned large increases in such basic components of war materiel as steel, aluminum, and chemicals will entail plans for adequate electric power, but such increases do not necessarily indicate warlike intentions.

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APPENDIX A

ELECTRIC GENERATING PLANTS IN POLAND

A list of all of the electric generating plants in Poland having a capacity of 5,000 kw or greater is shown in Table 6.* The type of plant -- thermal or hydroelectric -- has been indicated, and, to the extent possible, any variation in the name of the locality or of the individual plant has been indicated. In the "Type of Plant" column the proper names of the plants are given in parentheses if those names differ from the locality names. The plants indicated as "Regional" and "Municipal" contribute to the public supply under these categories, whereas the others supply the particular industries indicated and in most cases also contribute to the public supply.

With some exceptions, the 1950 listing of plants and their capacities is based on the Yearbook of the Industry of Regenerated Poland, a Polish document published by the State Graphic Establishments, Warsaw, 25 March 1948. As far as can be determined, the figures are "official" or at least were compiled from "official" records. The Yearbook indicates the status of plants in 1946. Any known changes between 1946 and 1950 have been incorporated in the 1950 listing.

The capacities in the 1955 listing were developed by applying to the 1950 listing information received before 15 January 1955 on additions or deletions of plant capacity which took place after 1950.

The plants indicated as "planned" or "under construction" will probably be put into operation during the next Plan period. Because very little information is available concerning the condition of the generating equipment (turbines, generators, and boilers) and concerning the reduction in capacity as a result of failures and retirement of old equipment, the capacities noted should be considered the optimum installed capacity, especially in the older plants. It must also be considered that some of the smaller plants, because of their low efficiency, may not be operating or may be operating only as peak-load stations.

* Table 6 follows on p. 28.

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Table 6
Electric Generating Plants in Poland a/*
1950 and 1955

Locality	Coordinates	Type of Plant	Type of Power b/	Installed Capacity (Thousand Kilowatts)	
				1950	1955
Bedzin	50°20' N - 19°09' E	Regional (Dabrows) c/	T	23.5 d/	23.5 d/
Belgard (see Bialogard)					
Beuthen (see Bytom)					
Bialogard (Belgard)	54°00' N - 16°00' E	Municipal	T	14.0 d/	24.8 d/
Bialy Kamien (Weissstein)	50°47' N - 16°15' E	Coal mine	T	14.0 d/	14.0 d/
Bialystok	53°08' N - 23°09' E	Municipal	T	7.9 d/	22.5 e/
Bielkowo	54°17' N - 18°30' E	Municipal	H	7.5 d/	7.5 d/
Blechnowia (Blechhammer)	50°22' N - 18°17' E	Synthetic fuel - North	T	144.0 f/	144.0 f/
Bobrek	50°20' N - 18°52' E	Steel foundry	T	7.0 d/	7.0 d/
Bobrowice (Bobersberg)	51°57' N - 15°05' E	Regional (Dychow)	H	7.0 d/	100.0 g/
Breslau (see Wroclaw)					
Brzeszcze (Bresha)	49°59' N - 19°09' E	Coal mine (Szczotki)	T	16.0 d/	16.0 d/
Brzozowice	50°22' N - 18°58' E	Coal mine (Andaluzja)	T	8.3 d/	8.3 d/
Bugobudowa (see Drohiczyn or Janow Podlaski) h/					
Bydgoszcz	53°09' N - 18°00' E	Municipal	T	15.5 d/	25.5 i/
Bytom (Beuthen)	50°21' N - 18°58' E	Municipal (Szombierki)	T	63.0 d/	98.5 d/
Chodakow	52°16' N - 20°18' E	Textile plant	T	9.3 d/	9.3 d/
Chorzow	50°18' N - 18°58' E	Municipal (Miechowice)	T	200.0 j/	200.0 j/
Chorzow		Municipal (Slazel)	T	109.0 d/	193.0 k/
Chwalowice	50°04' N - 18°34' E	Chemical plant	T	71.0 l/	113.0 l/
Cieplice (see Siechnice)		Coal mine	T	10.8 d/	10.8 d/
Cieszyn	49°46' N - 18°36' E	Regional	T	5.2 d/	5.2 d/
Czchow	49°50' N - 20°41' E	Regional	H	10.0 m/	14.8 n/
Czechnowice (see Siechnice)					
Czechnowice	49°53' N - 19°01' E	Regional	T	17.2 d/	17.2 d/
Czeladz	50°19' N - 19°06' E	Coal mine	T	14.0 d/	14.0 d/
Czerwionka	50°10' N - 18°41' E	Coal mine (Debiensko)	T	8.4 d/	8.4 d/

* Footnotes for Table 6 follow on p. 37.

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Table 6
Electric Generating Plants in Poland a/
1950 and 1955
(Continued)

Locality	Coordinates	Type of Plant	Type of Power b/	Installed Capacity (Thousand Kilowatts)	
				1950	1955
Czestochowa	50°48' N - 19°07' E	Regional	T	20.9 d/	50.9 e/
Czestochowa		Cotton mill	T	5.0 d/	5.0 d/
Czorzyn	49°26' N - 20°19' E	Regional	H		70.0 o/
Dabrowa Gornicza	50°20' N - 19°12' E	Steel foundry	T	6.4 d/	6.4 d/
Dabrowa Gornicza		Coal mine (Zwadzki)	T	13.6 d/	13.6 d/
Danzig (see Gdansk)					
Debiensko Wielkie					
(see Czerwionka)					
Drobiczyn	52°24' N - 22°39' E	Regional (Bug I)	H	Planned p/	
Dwory	50°02' N - 19°17' E	Chemical plant	T		150.0 g/
Dychow (see Bobrowice)					
Dynow	49°49' N - 22°14' E	Regional	H		40.0 r/
Elblag (Elbing)	54°10' N - 19°23' E	Municipal	T	19.3 d/	47.7 d/
Gdansk (Danzig)	54°21' N - 18°40' E	Municipal	T	34.0 j/	34.0 j/
Gdynia (Gdingen)	54°30' N - 18°33' E	Municipal (Grodek)	T	10.0 e/	20.0 e/
Gdynia (Gdingen)		Municipal (nowa) (shipyard)	T	10.0 e/	20.0 e/
Glatz (see Klodzko)					
Gliwice (Gleiwitz)	50°17' N - 18°40' E	Coal mine	T	10.8 e/	50.0 t/
Glogow (Glogau)	51°40' N - 16°06' E	Municipal	T	6.6 d/	6.6 d/
Goleszow	49°44' N - 18°45' E	Cement plant	T	6.1 d/	6.1 d/
Gorlitz (see Wegliniec)					
Gorzow (Landaberg)	52°44' N - 15°14' E	Rayon factory	T	14.0 j/	42.0 v/
Goslawice (Goslawitz)					
(see Konin)					
Grodek	53°31' N - 18°22' E	Regional	H	12.0 v/	12.0 v/
Grodziec (Friedrichs- Graetz)	50°21' N - 19°06' E	Coal mine	T	11.0 d/	11.0 d/

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Table 6
 Electric Generating Plants in Poland a/
 1950 and 1955
 (Continued)

Locality	Coordinates	Type of Plant	Type of Power ^{b/}	Installed Capacity (Thousand Kilowatts)	
				1950	1955
Grodziec (Friedrichs-graetz)	50°21' N - 19°06' E	Coal mine (Jowisz)	T	32.0 d/	32.0 d/
Groszowice (Groschowitz)	50°38' N - 17°58' E	Cement plant	T	10.0 d/	13.0 x/
Grudziadz	53°29' N - 18°46' E	Municipal	T	6.8 d/	6.8 d/
Hindenburg (see Zabrze)					
Janow (see Szopienice)					
Janow Podlaski	52°12' N - 23°13' E	Regional (Bug II)	H	Planned p/	
Jaworzno	50°13' N - 19°17' E	Coal mine (Bierut)	T	39.1 d/	39.1 d/
Jaworzno		Municipal I	T	80.0 y/	120.0 y/
Jaworzno		Municipal II	T	150.0 z/	150.0 z/
Jaworzno		Chemical plant (Azot)	T	6.3 d/	18.8 s/
Jeziorna	52°06' N - 21°08' E	Paper mill (Mirkowska)	T	6.0 ea/	6.0 ea/
Kalety	50°34' N - 18°54' E	Paper mill (Natronag)	T	8.5 d/	8.5 d/
Kalisz	51°45' N - 18°05' E	Regional (Czemka)	T	4.2 bb/	10.1 cc/
Katowice (see Stalinograd)					
Kazimierz	50°18' N - 19°14' E	Coal mine (Juliusz)	T	26.5 d/	26.5 d/
Kedzierzyn (Heydebreck)	50°21' N - 18°12' E	Chemical plant (Blachownia - South)	T	75.0 da/	75.0 da/
Kielce	50°50' N - 20°40' E	Municipal	T	6.5 y/	6.5 y/
Klodzko (Glatz)	50°26' N - 16°39' E	Municipal (Skaleczyn)	T	10.4 d/	10.4 d/
Knurów	50°13' N - 18°40' E	Coal mine	T	7.5 s/	14.5 e/
Kohlfurt (see Wegliniec)					
Konin	52°13' N - 18°16' E	Lignite Combine II	T		62.5 ee/
Konigschuette (see Chorzow)					
Kostuchna	50°12' N - 19°00' E	Coal mine (Boze Dary)	T	7.2 d/	7.2 d/

Table 6
 Electric Generating Plants in Poland a/
 1950 and 1955
 (Continued)

Locality	Coordinates	Type of Plant	Type of Power b/	Installed Capacity (thousand Kilowatts)	
				1950	1955
Kraftborn (see Siechnice)	50°05' N - 19°55' E	Municipal	T	22.0 d/	22.0 d/
Krakow	approximately				
Kunice (Kunzendorf) (near Sorau)	51°36' N - 15°10' E	Municipal (Loza)	T	3.3 ff/	5.3 ff/
Landsberg (see Gorzow)					
Laziska Gorne	50°09' N - 18°51' E	Chemical plant (Elektro)	T	157.1 gg/	157.1 gg/
Laziska Gorne		Coal mine (Boleslaw Smialy)	T	5.3 d/	5.3 d/
Lazowo (see Kunice)					
Legnica (Liegnitz)	51°12' N - 16°12' E	Municipal	T	15.2 d/	15.2 d/
Libisz Wielki	50°06' N - 19°18' E	Coal mine (Janina)	T	6.6 u/	6.6 u/
Lodz	51°04' N - 19°28' E	Municipal (new)	T	Planned	hh/
Lodz		Cotton mill No. 5 (Geyer)	T	11.1 d/	11.1 d/
Lodz		Cotton mill No. 2 (Marchlewski)	T	5.9 d/	6.1 ff/
Lodz		Cotton mill No. 1	T	5.0 d/	5.0 d/
Lodz		Cotton mill (old)	T	91.2 d/	91.2 d/
Lublin	51°15' N - 22°34' E	Municipal	T	5.8 d/	10.0 j/
Ludwikowo (Ludwigshof)	50°37' N - 16°29' E	Municipal	T	15.9 u/	29.9 u/
Miechowice (see Chorzow)					
Mikulczyce (Klausberg)					
Mittelsteine (see Scinawka Srednia)	50°20' N - 18°47' E	Coal mine	T	12.0 d/	12.0 d/
Mlociny (near Warsaw)	52°18' N - 20°56' E	Regional	T	Under construction	jj/
Modrzejow	50°15' N - 19°09' E	Coal mine (Niwka)	T	22.5 kk/	22.5 kk/
Moscice	50°01' N - 20°56' E	Nitrogen factory	T	24.9 u/	24.9 u/

Table 6
 Electric Generating Plants in Poland a/
 1950 and 1955
 (Continued)

Locality	Coordinates	Type of Plant	Type of Power b/	Installed Capacity (Thousand Kilowatts)	
				1950	1955
Myslowice	50°14' N - 19°09' E	Coal mine	T	11.0 d/	13.5 d/
Myszkow	50°35' N - 19°21' E	Paper mill	T	19.0 d/	19.0 d/
Niemce	51°22' N - 22°38' E	Coal mine (Julius)	T	9.5 aa/	9.5 aa/
Nowa Huta	50°05' N - 20°04' E	Steel combine (Lenin)	T		50.0 ll/
Nowa Huta Port (see Przewoz)					
Nowa Wies (Wirek)	50°16' N - 18°52' E	Coal mine (Hillebrand)	T	8.8 aa/	8.8 aa/
Nowy Bytom	50°17' N - 18°53' E	Steel plant (Poko)	T	13.7 d/	22.0 mm/
Nowy Sacz (see Roznow)					
Opalenica	52°18' N - 16°26' E	Sugar refinery	T	6.1 d/	6.1 d/
Ostroleka	53°05' N - 21°34' E	Municipal	T		100.0 mm/
Ostrowiec	50°56' N - 21°24' E	Steel foundry	T	5.1 d/	5.1 d/
Oswiecim (see Dwory)					
Pabianice	51°40' N - 19°22' E	Cotton mill	T	6.8 d/	6.8 d/
Pilichowice	51°15' N - 20°08' E	Regional I	H	8.0 d/	8.0 d/
Police (Politz)	53°33' N - 14°34' E	Synthetic fuel	T	5.0 oo/	5.0 oo/
Porabka	49°49' N - 19°14' E	Regional	H		16.5 pp/
Poznan	52°25' N - 16°58' E	Municipal (new)	T	35.0 d/	65.0 qq/
Poznan		Municipal (old)	T	10.0 d/	20.0 rr/
Poznan		Locomotive works (Cegielski)	T	5.4 d/	5.4 d/
Pruszkow	52°10' N - 20°50' E	Regional (Warsaw)	T	23.0 ss/	38.0 s/
Przewoz (Nowa Huta Port)	50°03' N - 20°04' E	Municipal	H	Under construction	ll/
Pzereno (suburb Swidnica)	50°51' N - 16°30' E	Sugar mill (Swidnica)	T	6.7 d/	6.7 d/

Table 6
Electric Generating Plants in Poland a/
1950 and 1955
(Continued)

Locality	Coordinates	Type of Plant	Type of Power b/	Installed Capacity (Thousand Kilowatts)	
				1950	1955
Pszow	50°03' N - 18°25' E	Coal mine (Anna)	T	18.5 d/	24.8 d/
Radlin	50°02' N - 18°28' E	Coal mine (Emma)	T	23.7 d/	23.7 d/
Radzionkow	50°25' N - 18°55' E	Coal mine	T	8.6 tt/	8.6 tt/
Roznow	49°46' N - 20°42' E	Regional	H	50.0 uv/	62.5 vv/
Ruda	50°19' N - 18°51' E	Coal mine (Mikolaj)	T	32.8 d/	32.8 d/
Rudawa	50°08' N - 19°43' E	Paper mill	T	7.2 d/	7.2 d/
Rydułtowy	50°04' N - 18°26' E	Coal mine	T	11.4 d/	11.4 d/
Scinawka Srednia (Mittelsteine)	50°32' N - 16°29' E	Railroad (Glatz-Breslau)	T	12.0 v/	34.0 vv/
Siechnice (Kraftborn)	51°02' N - 17°09' E	Regional	T	11.5 j/	61.5 xx/
Siemianowice	50°18' N - 19°02' E	Coal mine I	T	12.0 d/	19.8 d/
Siemianowice		Coal mine II	T	17.4 d/	17.4 d/
Siersza Wodna	50°11' N - 19°28' E	Regional	T	8.5 d/	22.5 d/
Smukala	53°12' N - 17°58' E	Regional	H	Planned j/	
Stalinogrod (Katowice)	50°16' N - 19°01' E	Steel mill (Bałdona)	T	10.6 yy/	10.6 zz/
		Coal mine (Katowice)	T	11.3 d/	11.3 d/
		Coal mine (Kleofas)	T	8.9 d/	8.9 d/
		Coal mine (Wujek)	T	12.4 d/	12.4 d/
Stalowa Wola	50°34' N - 22°03' E	Regional (old)	T	40.0 d/	75.0 aa/
Stalowa Wola		Regional (new)	T	Under construction	bbb/
Starachowice	51°04' N - 21°04' E	Metal works	T	3.0 y/	10.5 ll/
Stettin (see Szczecin)	54°06' N - 22°56' E	Municipal	T	24.0 ccc/	24.0 ccc/
Suwalki					
Swiecie (see Zur)					
Swietochlowice	50°17' N - 18°55' E	Coal mine (Polska)	T	11.8 s/	11.8 s/
Swietochlowice		Foundry (Florian)	T	51.0 d/	51.0 d/
Swidnica (see Pszenno)					

Table 6
Electric Generating Plants in Poland a/
1950 and 1955
(Continued)

Locality	Coordinates	Type of Plant	Type of Power b/	Installed Capacity (Thousand Kilowatts)	
				1950	1955
Szczakowa	50°14' N - 19°17' E	Cement works	T	7.0 d	7.0 d/
Szczecin	53°25' N - 14°35' E	Municipal (Pommerensdorf)	T	Under construction	66.2 eee/
Szczecin		Municipal (Central II)	T	36.0 eee/	59.8 fff/
Szopienice	50°16' N - 19°07' E	Coal mine (St. George)	T	39.8 d/	13.5 d/
Tomaszow Mazowiecki	51°32' N - 20°01' E	Rayon factory No. 1	T	13.5 d/	Planned eee/
Turaszow (Turchau)	50°55' N - 14°55' E	Coal combine	T		161.5 iii/
Walbrzych (Waldenburg)	50°46' N - 16°17' E	Coal mine (Victoria)	T	113.4 hhh/	6.1 d/
Walbrzych		Chemical plant (Mieszko)	T	6.1 d/	6.5 d/
Walbrzych		Chemical plant (Boleslaw Chrobry)	T	6.5 d/	39.5 d/
Walbrzych		Municipal (Central I)	T	6.5 d/	6.5 d/
Warszawa (Warsaw)	52°15' N - 21°00' E	Municipal (Central II)	T	77.0 v/	117.0 j/
Warszawa		Municipal (Elektro)	T	12.9 jjj/	12.9 jjj/
Warszawa		Municipal (Wola Streetcar)	T	17.5 d/	150.0 kkk/
Warszawa		Municipal (Zeran)	T	17.5 d/	17.5 d/
Warszawa		Municipal (Kalawask)	T		6.2 ee/
Wegliniec (Kohlfurt)	51°17' N - 15°13' E	Manufacturing plant	T	6.2 ee/	5.4 d/
Weglewo (see Walbrzych)		Salt works	T	5.4 d/	5.3 d/
Weissstein (see Bialy Kamien)	51°41' N - 19°23' E		T	5.3 d/	15.5 d/
Widzew	49°59' N - 20°04' E		T	5.8 d/	13.0 j/
Wieliczka			T		
Wierek (see Nowa Wies)	51°56' N - 17°34' E	Sugar mill	T		
Witaszyce	52°39' N - 19°05' E	Paper mill	T		
Wloclawek		Regional (Kujawska)	T		
Wloclawek			T		
Wojkowice Komorne (see Grodziec)			T		

Table 6
 Electric Generating Plants in Poland a/
 1950 and 1955
 (Continued)

Locality	Coordinates	Type of Plant	Type of Power b/	Installed Capacity (Thousand Kilowatts)	
				1950	1955
Wroclaw (Breslau)	51°06' N - 17°02' E	Municipal	T	42.0 d/	45.3 d/
Wroclaw		Regional I	H	6.0 III/	6.0 III/
Wroclaw		Regional II	H	6.0 III/	6.0 III/
Wroclaw		Railroad car factory	T	8.3 S/	8.3 S/
Wrszcz (see Gdynia)					
Wysoka	50°26' N - 19°22' E	Cement works	T	7.5 d/	7.5 d/
Zabrze (Hindenburg)	50°19' N - 18°47' E	Municipal	T	65.0 S/	145.0 mmu/
Zegrze	52°28' N - 21°02' E	Regional	H		20.0 mmu/
Zeran (see Warszawa)					
Zgierz	51°51' N - 19°25' E	Municipal	T	6.9 d/	6.9 d/
Zur (suburb of Swiecie)	53°25' N - 18°27' E	Regional	H	7.0 S/	8.2 S/

Summary

Type of Plant	Number of Plants		Installed Capacity 000/ (Thousand Kilowatts)	
	1950	1955	1950	1955
Thermal electric plants	115	124	2,281	4,231
Hydroelectric plants	8	13	107	372
Total	123	137	2,388	4,603

Table 6
 Electric Generating Plants in Poland a/
 1950 and 1955
 (Continued)

Summary
 (Continued)

Size Range of Plants	Number of Plants		Installed Capacity 000/ (Thousand Kilowatts)	
	1950	1955	1950	1955
Plants over 100,000 kw	3	12	380	1,801
Plants 50 - 100,000 kw	8	17	548	1,189
Plants under 50,000 kw	112	108	1,460	1,613
Total	<u>123</u>	<u>137</u>	<u>2,388</u>	<u>4,603</u>
<u>Total Installed Capacity</u>				
Summation of Plant List			2,388	4,603
Plants under 5,000 kw (estimated)			582	777
Grand Total			<u>2,970</u>	<u>5,380</u>

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Table 6
 Electric Generating Plants in Poland a/
 1950 and 1955
 (Continued)

a. All known plants having a capacity of 5,000 kw or over.	q.	90/	ii.	108/	aaa.	126/
b. T stands for thermal electric; H, for hydroelectric.	r.	91/	jj.	109/	bbb.	127/
c. If the name of the power plant and its locality are not the same, the proper name of the plant is given in parentheses.	s.	92/	kk.	110/	ccc.	128/
d. 77/	t.	93/	ll.	111/	ddd.	129/
e. 78/	u.	94/	mm.	112/	eee.	130/
f. 79/	v.	95/	nn.	113/	fff.	131/
g. 80/	w.	96/	oo.	114/	ggg.	132/
h. 81/	x.	97/	pp.	115/	hhh.	133/
i. 82/	y.	98/	qq.	116/	iii.	134/
j. 83/	z.	99/	rr.	117/	jjj.	135/
k. 84/	aa.	100/	ss.	118/	kkk.	136/
l. 85/	bb.	101/	tt.	119/	lll.	137/
m. 86/	cc.	102/	uu.	120/	mmm.	138/
n. 87/	dd.	103/	vv.	121/	nnn.	139/
o. 88/	ee.	104/	ww.	122/	ooo.	The figures have been
p. 89/	ff.	105/	xx.	123/		rounded to the nearest
	gg.	106/	yy.	124/		thousand kilowatts.
	hh.	107/	zz.	125/		

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APPENDIX B

METHODOLOGY

1. Capacity.

The methods used in developing the estimates of installed capacity of Polish electric power plants for 1951-55 are explained by the following methodology.

The installed capacity of plants having a capacity of 5,000 kw or more was established from Appendix A for the year 1950. For each succeeding year through 1955 the total amount of new capacity reported or estimated to have been installed in each year was added, this total being the sum of additions to individual plants named in Appendix A.

The total capacity of plants having capacities of less than 5,000 kw for the year 1950 is the difference between the announced capacity of 2.970 million kw and the plant list capacity of 2.388 million kw. In the following years this was increased at a rate of approximately 6 percent. Although this is less than half of the average annual increase in the total capacity, it is considered reasonable because it includes the older plants which are probably not being rebuilt or maintained and the small plants which are not being expanded. The estimated installed capacity of electric power plants in Poland in the 1950-55 period is shown in Table 7.*

The predicted capacities for 1956 through 1960** are based on an average annual increase of 11.6 percent, which is the average increase during the Six Year Plan.

2. Production.

Official statistics on the production of electric power in Poland are available through 1954, but in recent years they have been stated as a percentage increase over the previous year.

* Table 7 follows on p. 40.

** See p. 8, above.

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Table 7

Estimated Installed Capacity of Electric Power Plants in Poland
1950-55

	Million Kilowatts					
	<u>1950</u>	<u>1951</u>	<u>1952</u>	<u>1953</u>	<u>1954</u>	<u>1955</u>
Total installed capacity of plants having a capacity of 5,000 kw or more (from Appendix A)	2.388	2.664	3.035	3.469	3.992	4.603
Estimated installed capacity of plants having a capacity of less than 5,000 kw	0.582	0.616	0.655	0.691	0.738	0.777
Total national capacity	<u>2.970</u>	<u>3,280</u>	<u>3.690</u>	<u>4,160</u>	<u>4.730</u>	<u>5.380</u>

During the first 5 years of the Six Year Plan (1950-54), the average annual rate of increase was 13.2 percent. It is believed that the production of electric power will continue to increase at this rate for the last year of the Six Year Plan and through the next Plan period.

The officially reported production figure of 11.1 billion kwh in 1951, although less than 4 percent over the 1951 figure used in this report (see Table 2*), is believed to be erroneous, mainly because the fourth-quarter production is out of line with fourth-quarter production in previous years and because the announced percentage increases of 12.5 percent and 13 percent for 1952 and 1953 do not result in the announced 1953 production of 13.6 billion kwh.

3. Manpower.

Because manpower statistics concerning total employment for the electric power industry are scarce and the available information is conflicting and generally not on an equivalent basis, it was necessary to construct a year-by-year tabular study based on the main body of workers (operation personnel in power plants) in both the public

* P. 12, above.

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utilities and industrial plants. A decreasing scale was established for the number of workers per 1,000 kw in both categories based on the expected reduction of public utility employees per 1,000 kw, and the breakdown in capacity between public utility and industrial plants was established for the years 1946 through 1955. To the total number of plant operating personnel was added an estimate for all other employees -- those involved in transmission, distribution, clerical, engineering, and administrative duties. This group is estimated to be about 46 percent of the total employed by the industry. On the basis of planned employment figures, it is estimated that the range of error is between plus 10 and minus 5 percent. Estimated employment in the electric power industry in Poland during the 1946-55 period is shown in Table 8.*

* Table 8 follows on p. 42.

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Table 8
 Estimated Employment in the Electric Power Industry in Poland
 1946-55

Year	Public Utilities			Industrial			All Others (Thousand Workers)	Total Thousand Workers
	Workers per Thousand Kw	Capacity (Million Kw)	Thousand Workers	Workers per Thousand Kw	Capacity (Million Kw)	Thousand Workers		
1946	8.6	1.13	9.7	5.0	1.01	5.1	12.2	27
1947	8.5	1.20	10.2	4.9	1.09	5.3	13.5	29
1948	8.4	1.30	10.9	4.8	1.16	5.6	14.5	31
1949	8.3	1.52	12.6	4.7	1.27	6.0	15.4	34
1950	8.1	1.66	13.4	4.6	1.31	6.0	16.6	36
1951	7.9	1.88	14.9	4.5	1.38	6.2	17.9	39
1952	7.6	2.21	16.8	4.3	1.48	6.4	19.8	43
1953	7.3	2.57	18.8	4.2	1.59	6.7	21.5	47
1954	6.9	3.01	20.8	4.1	1.72	7.1	23.1	51
1955	6.4	3.50	22.4	4.0	1.88	7.5	25.1	55

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APPENDIX C

GAPS IN INTELLIGENCE

Before 1949, statistical yearbooks published by the government of Poland provided much valuable information on the electric power industry for such items as production, the number and size of plants, breakdown of consumption by various categories and by regions, and various other factors. Since 1949 this type of material has not been published or has not been available. In addition, much of the current material is from sources having little technical knowledge of the industry, with the result that many important items are not observed or are reported in such form as to make them difficult to interpret. Information is needed on the following:

1. Power plants -- particularly the larger ones -- on installed capacity; production during a fixed period, such as quarterly or annually; marked changes in equipment or operating hours; and plans for enlargement.
2. New high-voltage transmission lines and their actual or proposed interconnection to the existing network.
3. Electric consumption by principal classes of users and particularly by specific industries which are large users of power.
4. Inputs, including quantity and source of equipment; manpower; technical assistance; and investment required.
5. Export and import of electric power across international boundaries.

Although the above gaps exist, it should not be inferred that information is completely lacking. There is a quantity of information available on the larger plants, some conflicting and some confirming, but nothing to give the complete picture of each plant. The remaining gaps are large with only a smattering of information which is difficult to piece together.

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APPENDIX D

SOURCE REFERENCES

All available sources have been explored, with the exception of some Polish language materials. It is believed, however, that there are no important omissions, because the Polish press, including periodicals, newspapers, monographs, and statistical documents, was comprehensively covered.

Below are listed the types of reports that were reviewed, although not all of the reports were used in the final survey:

25X1A

CIA Internal Reports: [REDACTED]

Intelligence Community: Army (PW, Attache, and G-2 reports)
Navy (Attache reports)
Air [REDACTED]

25X1A

25X1C

State (OIR and Embassy reports)

[REDACTED]

Not all types of the above reports will be found in the following source list, although many have been used to form an over-all picture of the existing situation.

The following two finished intelligence documents were used extensively for comparison and helped to reduce gaps in intelligence: NIS, chapter 14, section 62, Fuels and Power, Sep 52, S/US ONLY, [REDACTED]

25X1C

25X1C

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

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S-E-C-R-E-T

S-E-C-R-E-T

<u>Source of Information</u>	<u>Information</u>
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.

-
- 25X1A
1. CIA. Map Library, no 7924, F 307-24, Map of the Main Electric Transmission Lines, 1938, U. Eval. Doc.
CIA. FDB, translation no 37/49, 14 Jun 49, Yearbook of the Industry of Regenerated Poland, chap 5, part 3, C. Eval. Doc. (tr of Rocznik przemyslo odrondzonej Polski, 2d ed, Warsaw, 25 Mar 48)
 2. CIA. FDB, translation no 37/49, op. cit. (1, above).
 3. [REDACTED]
 4. [REDACTED]
 5. [REDACTED]
 6. UN, ECE, Committee on Electric Power. E/ECE/EP/131, Hydroelectric Potential in Europe and Its Gross Technical and Economic Limits, 18 May 53, U. Eval. RR 2.
 7. [REDACTED]
- 25X1A
- STATSPEC

S-E-C-R-E-T

25X1A8a

8. [REDACTED]

9. CIA. FDB, translation no 37/49, op. cit. (1, above).
10. ~~25X1A7~~ CIA. FDD, Summary, no 85, 11 Mar 53, S. Eval. RR 2.

11. [REDACTED]

12. CIA. Current Support Memorandum, no 155, 11 Aug 54, S.
Wiadomości elektrotechniczne, Warsaw, vol 12, no 8,
Aug 53, p. 170-173, U. Eval. RR 2.

13. CIA. FDB, translation no 37/49, op. cit. (1, above).

14. Rocznik statystyczny, 1949 (Statistical Yearbook, 1949),
Warsaw, 1950, U. Eval. Doc.

15. ~~25X1A7~~

16. [REDACTED]

25X1A

17. [REDACTED]
18. NIS 18, chap 6, sec 62, May 53, S/US ONLY.

19. [REDACTED]

25X1A2g

20. [REDACTED]
21. [REDACTED]

25X1A2g

22. [REDACTED]

23. Polish Planned Economy, Warsaw, 1948, U. Eval. RR 2.

24. [REDACTED]
25. [REDACTED]

STATSPEC

26. [REDACTED]
27. Rocznik statystyczny, 1949 (Statistical Yearbook, 1949),
Warsaw, 1950, U. Eval. Doc.

28. [REDACTED]

25X1A

29. UN, ECE. Economic Survey of Europe in 1951, Geneva, 1952,
U. Eval. RR 2.

STATSPEC

30. [REDACTED]
31. [REDACTED]

32. [REDACTED]

33. CIA. FDD, "Closer Integration of Soviet Bloc Economies
Planned," Summary, no 308, 14 Dec 54, C. Eval. RR 2.
(tr from SBZ Archiv, Cologne, 25 Sep 54)

25X1A

34. CIA. FDB, translation no 37/49, op. cit. (1, above).

35. [REDACTED]

36. UN, ECE. E/ECE/151, E/ECE/EP/126, Transfers of Electric
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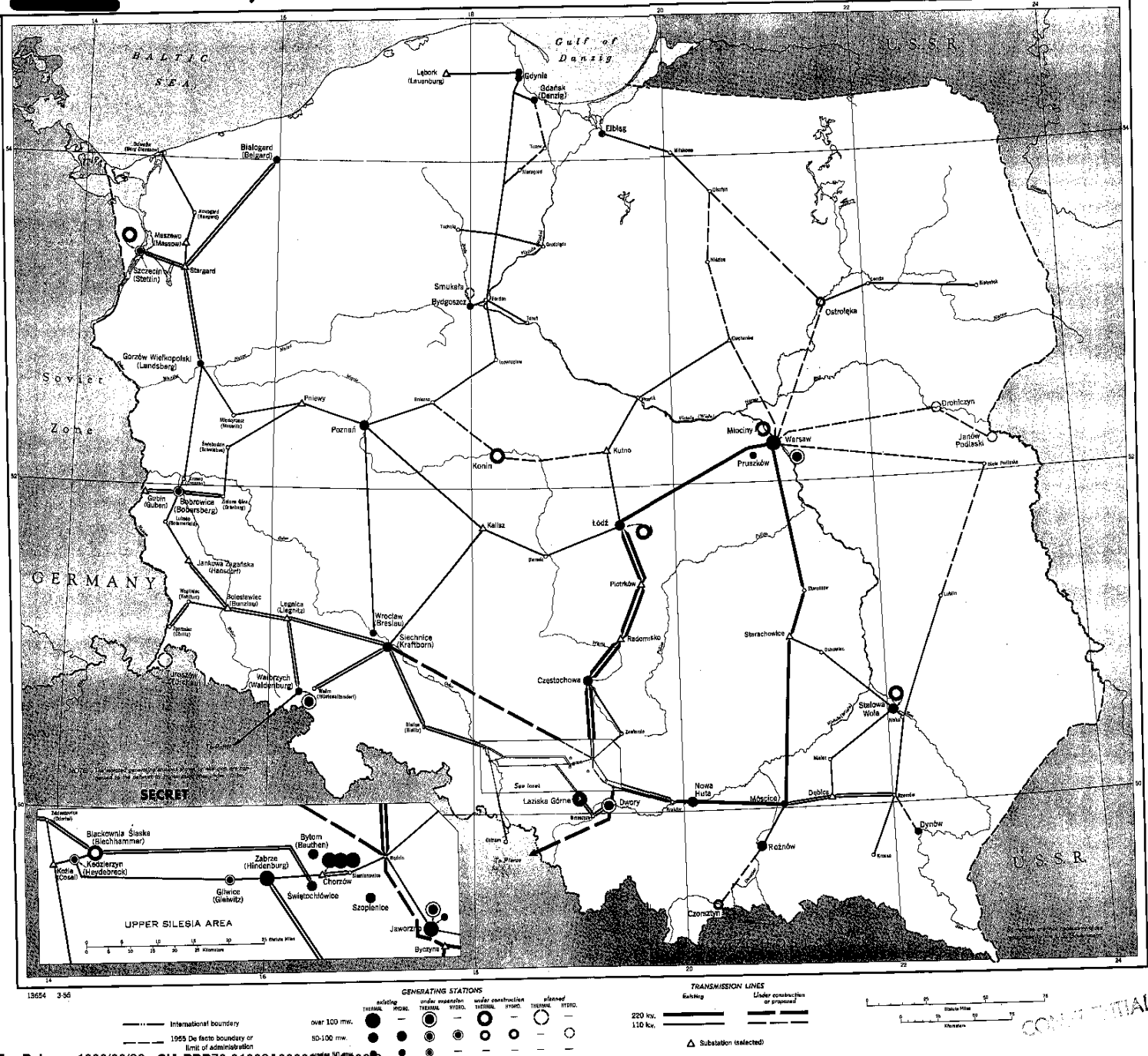
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Poland: Major Electrical Power Generating Stations and Transmission Lines

Figure 5



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