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CENTRAL INTELLIGENCE AGENCY

INFORMATION REPORT

REPORT [redacted]

CD NO.

COUNTRY Poland

SUBJECT Electric Power Consumption and Production by Polish Coal Mining Industry

PLACE ACQUIRED [redacted]

DATE ACQUIRED

DATE OF INFORMATION [redacted]

DATE DISTR. 11 Jul 1950

NO. OF PAGES 5

NO. OF ENCLS. (LISTED BELOW) 6

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SUPPLEMENT TO REPORT NO.

[redacted]

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[redacted]

1. [redacted] the following data concerning the Polish Coal Mining Industry as a consumer and producer of electric power in early 1948 for the International Bank for Reconstruction and Development in connection with Polish negotiations for a possible loan. [redacted]

<u>ELECTRIC POWER CONSUMPTION BY THE COAL INDUSTRY</u> 50X1-HUM

"In spite of the advanced electrification, there is still a great amount of steam and air driven machinery. There is also a small amount of internal combustion locomotives of lesser importance. In the auxiliary plants of the coal mining industry the electric power is exclusively used.

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"[redacted] limit the study of power consumption to two basic forms: steam and electricity. The compressed air power as an intermediate form of energy in the process of conversion of heat into mechanical work, needed for the drive of mining machinery, is derived from steam or electricity being thus taken into account in the balance of those two forms of energy. However it must be stressed that small efficiency of the compressed air drive has an influence on the power balance of the industry.

"The statistical data on the electric power consumption do not cause objections. The power consumption in kWh is sufficiently accurate, but the pre-war consumption in kW on the various mines may show some inaccuracies, when the mining unit possesses compressors with both electric and steam drive, of which some are usually in operation some in reserve as in case of a mine supplied by two power plants. The consumption of power of the Public Utility Power plants by a mine is usually calculated according to the so called maximum recorders, showing the maximal 15 minutes power supply in a month. Therefore the total consumption by the various units, as shown in statistics, is a little higher from the real total consumption.

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"The difference, however, for the whole mining industry is rather small. Records on power consumption of steam driven machines are more difficult to obtain and statistics are less accurate. The right measure of power consumption in that case is the work done by the motor. Practically it cannot be given in statistics. [redacted] express it by figures on steam consumption for the drive of machines. Not all steam generating plants have steam flow meters. [redacted] divide the boiler steam output into consumption for drive and heating purposes. Lack of measuring instruments does not allow accurate figures in statistics.

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"The same applies to the compressed air consumption figures. The mines do not possess flowmeters, measuring and recording instruments. Many mines give the air consumption, calculated out of the time of operation of the compressors, their rated capacity and the real number of r p m or from the consumption of electric power by the electric motor driving the compressor.

"Electric power consumption.

It depends on:

a) coal output
b) degree of mechanization and electrification of the mine
c) degree of coal preparation
d) mining conditions and methods
e) opening of new mines
f) auxiliary plants development

" a) Influence of the coal output on the consumption of electric power.

The estimated consumption of electric power is based on the real consumption in the various months of 1945-1947. The number of pick load hours is 4800 owing to the double shift work in all mines which makes it necessary to pump during the winding shifts. Many mines had to spread winding over the night shifts and Sundays.

The amount of energy needed would be according to the following formulas:

$$\text{Power requirements in kW} = 170{,}000 \div .00225x$$

$$\text{in kWh} = .86 \cdot 10^9 \div 10.4x$$

"Where x is the yearly output in m. tons.

Output 10^6 tons/year	kWh Required kWh/t	kWh Required 10^6 kWh/year	kW Required kW/1000 tons year	MW
60	24.7	1940	4.96	305
70	22.7	1590	4.63	327
80	21.2	1700	4.35	349
90	20.0	1800	4.13	372
100	19.0	1900	3.95	395

" b) Influence of the mechanization and electrification on the required electric power.

"The degree of mechanization on the whole is rather high. Some increase is expected in loading and mechanization of shaft bottom at some mines.

"There is also planned an electrification of winding machines, of the underground transport, as well as on the surface, electrification of compressors drive and reduction of the compressed air used underground. This is a long time program covering 20 to 25 years.

"There are 48% (expressed in capacity) steam driven winding machines. In the 10 year program the percentage of electric driven hoists will increase from 52 to 66%, which means an increase in output of electric wound tonnage by 14%.

$$\frac{0.14 \cdot 100 \cdot 10^9 \cdot 400}{3600 \cdot 102 \cdot 0,55} = 27,5 \cdot 10^6 \text{ kWh}$$

and average $\frac{27,5 \cdot 10^6}{3600} = 7700$ kW

where 400 m = average depth

and 3600 = number of winding hours

"The 10 year program program provides for installation of compressors of total capacity 818,000 cu. m. per hour. At the same time a capacity of old units of 282,000 cu. m will be withdrawn so that this increase will amount to 536,000 cu. m. with mainly electric drive. That means that the capacity of electric driven units will be about 50% of the total. Basing on the figures of 1947 of 4,000 full capacity operation and an energy supply of .11 kWh per cu. m., the increase of the capacity of electric driven compressors will be: 130,500 cu. m. per hour, and the necessary energy supply: 130,500 . 0,11 . 4000 = 57,5000,000 kWh/year.

"The operating units during 300 working days and 18 hours a day would demand a power of: $\frac{57,500,000}{18 \cdot 300} = 10,600$ kW

"The internal combustion locomotives with the exception of those of Lower Silesia will be replaced by electric trolley locos and this will increase the requirement of electric power by 3,330,000 kWh.

"Summing up [redacted] the following figures:

	kW	10^6 kWh/year
Hoists electrification	7,700	27.5
Compressors electrification	10,600	57.5
Traction electrification	740	3.3
	19,040	88.3

"c) Coal preparation plants

It consists of screening, washing, floatation and briquetting. Every mine has a screening plant although in many cases the plants are in very bad condition and they do not allow to separate coal fines 0 - 3 mm. With increasing depth of mining the quality of the product is getting worse and the seams thinner. The mines will have to be provided with washing plants especially those with coking coal. In the 10 year program there will be built 10 washing plants of a capacity of 4120 tons per hour assuming a supply of 1.5 kWh per ton and 16 hour work at 300 working days a year.

The consumption of electric energy will be

$4120 \cdot 1,5 \cdot 16 \cdot 300 = 29,5 \cdot 10^6$ kWh/year

pick load $4120 \cdot 1,5 = 6200$ kW

"d) Changes in geological conditions and working methods.

(1) lowering of working levels
(2) thickness and cleaness of seams
(3) hydraulic sand stowing

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"(1) Depth of working levels.

The working of one million tons of coal in the Polish Coal district is equivalent to lowering the operation level by 4". It is connected with an increased pumping and transport. In 10 years at an output of 800 million tons it will mean an average lowering by 80 m. The maximal output of 100 million tons a year would require:

$$\frac{100 \cdot 10^9 \cdot 0{,}66 \cdot 80}{3600 \cdot 102 \cdot 0{,}55} = 26 \text{ million kWh}$$

"Would all the pumps be operating the whole 24 hours the pick load would amount to: 315,000,000 . 8,760 = 3,600 kW

"Some mines with small aflux of water will pump during the night shift only. Therefore the increase of the pick load can be assumed 50% of the above i.e. 1800 kW.

"(2) Thickness and cleaness of seams.

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With the increased depth [redacted] thinner seams which means higher amounts of rock working and an extension of both transport and ventilation galleries. The last increase will be compensated by better concentration. The impurities in coal may increase by 5% which calls for 5% more energy supply.

10,4 . 100 000 000 . 0,05 = 52 000 000 kWh
and 0,00225 . 100 000 000 . 0,05 = 11250 kW

"(3) Hydraulic sandfilling.

The central sand mine should, at its highest capacity, supply: 45,000 cu. m. of sand per day.

"The pick load for excavating, transport of sand and pumping would be:

14980 kW
required energy 63,610,000 kWh

"e) New Mines.

They will take over the required energy of the mines which are going to be put out of operation.

"f) Summary of calculation of the energy requirement for the mines.

	MW	10^6kWh/year
out of regression curve	395	1900
mechanization & electrification	19	88.3
coal preparation	6.2	29.5
lowering of working level		
shafts	7.3	26.0
other transport	1.8	31.5
impurities in coal	11.25	52.0
sand filling	15.0	63.6
Total	455.55	2,190.9

"g) The possibility of reducing the energy requirement. 50X1-HUM

This could be achieved by:

(1) extension of the operation time at the pick load
(2) electrification of underground machinery

"The first means is very improbable as the time amounts already to 4800 hours as it has been achieved by working on Sundays.

"Even assuming 5000 hours of pick load operation it would save a small amount of energy: $\frac{455,5 - 2190.9}{5000} = 16,8$ MW

"The second way is by electrification of the underground machinery. The consumption of compressed air at 100 million tons yearly output will amount to 130 cu. m. per ton of coal produced as compared with 170 cu. m. at an output of 60 million tons per year.

"To obtain 1 kWh on the coupling of the air driven machine we have to supply 6 kWh on the busbars and at direct electric drive only 1,2 kWh.

"The electrification of the Polish mines will be limited by the:

a. difficulties in obtaining gas proof equipment

b. necessity of maintaining the pick hammers underground

c. unrentability of an electrification of the levels and mines in liquidation.

"It is estimated that the electrification of underground machinery will reach about 35% of the theoretically possible and therefore reduce the amount of energy by 170 . 10^6 kWh and of the pick load of 32 MW.

"Coking plants.

The average energy consumption per 1 ton of coke produced is practically independent from the amount produced and is estimated as 16,5 kWh

total requirements: 82 . 10^6 kwh/year

and 10,8 MW

"Factories and workshops.

The factories and workshops owned by the coal mining industry will increase their manufacturing capacity and energy requirement as follows:

	Manufacturing capacity	Energy requirement
1947	21,000 t/year	4,400,000 kWh/year 1,220 MW
1957	45,000 t/year	8,500,000 kWh/year 2,350 MW

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Enclosure A - Requirement of Electrical Energy of the Polish Coal Mines in 1948 - 1957

Enclosure B - Consolidated Requirement of Electrical Energy of the Polish Coal Mining Industry in 1948 - 1957

Enclosure C - Coal Mining Industry in Poland
Enclosure D - Monthly Output of Bituminous Coal, Coke, By-Products, Electric Power of the Polish Coal Mining Industry in 1947
Enclosure E - Polish Coal & Coke Exports
Enclosure F - Polish Coal Mining Industry Manpower

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REQUIREMENT OF ELECTRICAL ENERGY OF THE POLISH COAL MINES IN 1948 - 1957

Year	Planned Output	Consumption of electrical energy			Increase of Consumption		Reduction of consumption		Planned Consumption		
	10^6t/yr	kWh/t	10^6kWh/yr	MW	10^6kWh	MW	10^6/kWh/yr	MW	10^6kWh/yr	MW	kWh/t
	59	25	1480	302.5	-	-	-	-	1460	302.5	24.8
1948	67	23.3	1560	321	28.2	5.9	16.5	3.1	1571.7	324	23.4
1949	73	22.2	1620	334	56.4	11.8	33	6.2	1643.4	338.6	22.6
1950	78	21.5	1670	346	84.6	17.7	49.5	9.3	1705.1	354.4	21.8
1951	80	21.2	1700	350	112.8	23.6	66	12.4	1746.8	361.8	21.8
1952	83	20.8	1730	356.5	141.0	29.5	82.5	15.5	1788.5	370.5	21.6
1953	87	20.3	1770	360	169.2	35.4	99	18.6	1840.2	382.8	21.2
1954	89	20.1	1790	370	197.4	41.3	115.5	21.7	1871.9	389.6	21
1955	92	19.8	1820	377	225.6	47.2	132	24.8	1913.6	399.4	20.8
1956	95	19.5	1850	384	253.8	53.1	148.5	27.9	1955.3	409.3	20.7
1957	97	19.3	1870	388	282	59	165	31	1987	416	20.5
1958	100	19	1900	395	290.9	60.55	170	32	2020.9	422.5	20.2

ENCLOSURE "A"

ENCLOSURE "B"

CONSOLIDATED REQUIREMENT OF ELECTRICAL ENERGY

OF THE POLISH COAL MINING INDUSTRY IN 1948 - 1957

Planned energy consumption by:

Year	Coal Mines		Coking plants		Factories		Others		Total	
	10^6kWh/year	MW	10^6kWh/year	MW	10^6kWh/year	MW	10^6kWh/year	MW	10^6kWh/year	MW
1947	1460	302.5	86	--	4.64	--	--	--	1559.-	315.-
1948	1571.5	324	49.5	6.5	4.81	1.333	30	7.5	1655.81	339.33
1949	1643.4	339.6	57.8	7.6	5.22	1.446	30	7.5	1736.42	356.20
1950	1705.1	354.4	55.1	7.3	5.63	1.559	30	7.5	1795.83	370.30
1951	1746.8	361.8	64.6	8.5	6.04	1.672	30	7.5	1847.44	378.9
1952	1788.5	370.5	71.4	9.4	6.45	1.785	30	7.5	1895.35	389.2
1953	1849	382.8	73.3	9.65	6.86	1.898	30	7.5	1950.16	401.9
1954	1871.9	389.6	79.6	10.45	7.27	2.011	30	7.5	1988.77	409.55
1955	1913.6	399.2	81.2	10.7	7.68	2.124	30	7.5	2032.48	419.5
1956	1955.3	409.3	82.3	10.8	8.09	2.237	30	7.5	2075.69	429.84
1957	1987	416.-	82.3	10.8	8.5	2.35	30	7.5	2107.80	436.65
1958	2020.9	422.5	82.3	10.8	8.5	2.35	30	7.5	2141.70	443.15

The installed power at the power plants should be increased by 15% for own consumption of the powerplant and losses in transmission.

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Coal Mining Industry in Poland

(Number of persons employed on December 31, 1947)

	District Unit	Manual Workers		Total	Office Workers		Total	Total
		underground	surface		technical	clerical		
		1	2	3	4	5	6	3 + 6
I.	Jaworzno-Mikołow	14,841	7,266	22,107	962	755	1,717	23,824
II.	Dabrowa	15,710	8,566	24,276	1,109	917	2,026	26,302
III.	Katowice	12,556	6,009	18,565	900	668	1,568	20,133
IV.	Chorzow	13,150	5,535	18,685	857	663	1,520	20,205
V.	Ruda	14,271	5,613	19,984	921	684	1,605	21,589
VI.	Bytom	12,211	5,613	17,824	846	520	1,366	19,190
VII.	Zabrze	14,456	5,396	19,852	662	550	1,212	21,064
VIII.	Gliwice	16,587	5,610	22,197	755	502	1,257	23,454
IX.	Rybnik	14,399	5,987	20,386	693	598	1,291	21,677
X.	Dolny-Slask	12,918	5,081	17,999	821	484	1,305	19,304
	Total. . . .	141,199	60,676	201,875	8,526	6,341	14,867	216,742

ENCLOSURE "C"

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ENCLOSURE "D"

MONTHLY OUTPUT OF BITUMINOUS COAL, COKE, BY-PRODUCTS, ELECTRIC POWER

OF THE POLISH COAL MINING INDUSTRY IN 1947

Product	January m. tons	February m. tons	March m. tons	April m. tons	May m. tons	June m. tons
Bituminous coal	4,548,479	4,136,862	4,792,902	4,650,211	4,459,199	4,581,492
Brown Coal	382,086	321,652	362,470	380,511	420,307	399,223
Coke	210,787	194,090	233,695	232,250	247,021	241,891
Bit. coal briquettes	48,330	35,589	45,873	51,059	49,551	56,593
Brown coal briquettes	2,763	2,306	2,797	3,266	3,377	2,844
Tar	7,713.0	6,883.0	7,905.0	8,145.8	8,498.4	8,306.5
Benzol	1,829.6	1,436.0	2,115.6	2,381.4	2,600.7	2,418.7
Ammonium sulphate	1,814.3	1,641.0	2,039.0	2,184.9	2,179.5	2,035.2
Coke gas in 1000 cu. m.	84,454.5	76,047.0	89,560.4	89,071.9	93,854.5	91,988.6
Electric power in 1000 kWh	124,273	109,935	118,798	109,487	112,639	111,469

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Product	July m. tons	August m. tons	September m. tons	October m. tons	November m. tons	December m. tons	Total m. tons
Bituminous coal	5,086,512	5,107,205	5,367,005	5,760,558	5,421,360	5,218,550	59,130,335
Brown Coal	413,541	431,658	416,790	433,267	412,762	389,197	4,763,464
Coke	253,760	253,619	244,403	249,733	249,747	256,796	2,867,792
Bit. coal briquettes	63,247	56,507	59,035	58,232	53,025	55,183	632,224
Brown coal briquettes	3,738	3,856	4,923	5,572	2,861	3,395	41,698
Tar	8,453.5	8,251.2	8,074.0	8,715.4	8,556.3	8,877.9	98,350.0
Benzol	2,612.4	2,818.1	2,701.0	2,996.3	2,939.5	3,013.6	29,862.9
Ammonium sulphate	2,150.1	2,309.9	2,034.9	2,162.5	2,153.3	2,204.0	24,908.6
Coke gas in 1000 cu. m.	94,361.1	93,777.1	91,634.0	96,955.0	93,316.1	95,574.1	1,090,594.3
Electric power in 1000 kWh	121,183	125,070	123,567	132,276	135,032	139,500	1,463,229

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ENCLOSURE "E"

POLISH COAL & COKE EXPORTS

Provisional figures for 1947 in m. tons

	Coal	Coke	Total
[redacted]			
Other Countries	10	-	10
Czechoslovakia	910	20	930
[redacted]			
Germany (Russian Zone)	250	140	390
Hungary	140	120	260
Yugoslavia	60	130	190
Rumania	50	-	50
USSR	8630	190	8820
Foreign Bunker	450	-	450
Total.	17750	1480	19230

ECO Countries		8,190 - 43%
Other European Countries		2,220 - 11%
USSR		8,820 - 46%
		19,230
By sea	7,020	
By land	12,210	19,230

[redacted]

ENCLOSURE "F"

POLISH COAL MINING INDUSTRY MANPOWER

(November 30, 1947)

District Unit	Coal Mines		Auxiliary Branches		Total	
	Manual	Office	Manual	Office	Manual	Office
Jaworz. Miloj.	21536	1723	3213	803	24749	2526
Dadrowa	24153	2008	1929	755	26082	2763
Katowice	18231	1571	1724	547	19955	2118
Chorzow	18484	1508	1320	661	19804	2169
Rudza	19990	1586	4549	822	24539	2408
Bytom	18200	1296	1361	710	19561	2006
Zabrze	19806	1192	2271	660	22077	1852
Gliwice	22222	1230	2214	661	24436	1891
Rybnik	20069	1292	3297	771	23366	2063
Dolnosl.	18022	1316	5350	1244	23372	2560
TOTAL.....	200713	14722	27228	7634	227941	22356
Auxiliary Units			20551	6070	20551	6070
Brown Coal	2656	230	905	293	3561	523
GRAND TOTAL....	203369	14952	48684	13997	252053	28949