IMPACT OF OIL EXPORTS FROM THE SOVIET BLOC

Volume II

A Report of the

NATIONAL PETROLEUM COUNCIL

—1962—

IMPACT OF OIL EXPORTS FROM THE SOVIET BLOC

Volume II

P R E F A C E

This is Volume II of a two-volume report of the National Petroleum Council. On November 28, 1961, the Assistant Secretary of the Interior, the Hon. John M. Kelly, wrote to Walter S. Hallanan, then Chairman of the National Petroleum Council, as follows:

> "The Department of the Interior views with concern the growing shipments of petroleum from the Soviet Bloc to the Free World. Because of the varied but widespread impact of these shipments upon Free World nations and upon international relationships between the United States and other nations, it is greatly in the interest of national security for this situation to be better understood.
>
> Accordingly, the National Petroleum Council is requested to make a factual study of the effects on the Free World of the exports of petroleum from the Soviet Bloc, together with such comments and conclusions as are deemed appropriate."

Pursuant to this request, the National Petroleum Council established the Committee on the Impact of Oil Exports from the Soviet Bloc, and the Working Subcommittee thereof. The Subcommittee gathered and studied a vast number of facts and data related to oil exports from the Soviet Bloc. The comprehensive detail obtained and examined by the Subcommittee comprises this Volume II. In Volume I the Subcommittee presents its comments and conclusions, based upon an analysis of the detailed data contained in Volume II, as well as a concise summary of Volume II.

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	MULTIPLIED BY	EQUALS
Meters	3.281	Feet
Kilometers	0.621	Miles
Cubic Meters	35.314	Cubic Feet
Metric Ton	1.102	Short Tons
Metric Ton	7.3	Barrels
Metric Tons Per Year	0.02	Barrels Per Day
Barrels Per Day	50	Metric Tons Per Year
Hectare	2.471	Acres
Square Kilometer	0.386	Square Miles
Square Meter	10.764	Square Feet

A metric ton of standard fuel has a calorific value of 7,000,000 kilocalories, or the equivalent of 27,780,000 British thermal units. For the USSR, to convert the following types of fuel from units of natural measure to units of standard fuel, apply these factors:

TYPE OF FUEL	1950	1958	1959	1960	1961	1962	1965	1970	1975	1980
Coal*	0.7878	0.7299	0.7304	0.7270	0.7300	0.7400	0.7500	0.7800	0.7800	0.7800
Crude Oil*	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43
Natural Gas**	1.267	1.207	1.201	1.201	1.201	1.2	1.2	1.2	1.2	1.2
Peat*	0.411	0.396	0.380	0.381	0.380	0.380	0.380	-	-	-
Shale*	0.2757	0.3412	0.3362	0.3393	0.340	0.340	0.3488	-	-	-
Hydroelectric Power***	0.590	0.485	0.477	0.468	0.459	0.450	0.396	0.360	0.325	0.290
Nuclear Electric Power***	-	-	-	-	-	-	0.455	-	-	-

* Given factor times quantity expressed in metric tons yields metric tons of standard fuel.
** Given factor times quantity expressed in thousand cubic meters yields metric tons of standard fuel.
*** Given factor times quantity expressed in thousand kilowatt-hours yields metric tons of standard fuel.

Conversion factors for the various fuels as regards the European Satellite countries are given in Table 4-3, p. 278

Prior to January 1, 1961, the official exchange rate set the value of the ruble at 25¢ or 4 rubles to $U.S. 1. The tourist exchange rate provided 10 rubles for each $U.S. 1, or 10¢ for each ruble. The ruble reform, which took place at the beginning of 1961, represented a devaluation of that currency. The new ruble, equal to 10 old rubles, was then declared to be worth $U.S. 1.11. There are 100 kopecks to 1 ruble; hence the value of 1 kopeck is 1.11¢.

All of the ruble quotations in this report are in new rubles. In addition, all conversions of rubles to $U.S. made by the Committee have been made at the existing official exchange rate.

All tons in this volume of the report are given in metric tons.

LISTING OF REPUBLICS AND

ECONOMIC REGIONS OF THE SOVIET UNION

NAME OF REPUBLIC	ECONOMIC REGION* NAME	ECONOMIC REGION* NUMERICAL DESIGNATION
Russian Soviet Federated Socialist Republic (RSFSR)	Northwest	Ia
	North	Ib
	Transcaucasus	IV
	Volga	VI
	Center (Central)	VII
	Urals	VIII
	West Siberia	IX
	East Siberia	XI
	Far East	XII
Estonia, Latvia, Lithuania	Baltic	IIa
Belorussia (White Russia)	West	IIb
Ukraine, Moldavia	South	III
Georgia, Armenia, Azerbaydzhan	Transcaucasus	V
Kazakhstan	Kazakhstan	Xa
Uzbek, Tadzhik, Kirgiz, Turkmen	Central Asia	Xb

* For purposes of economic planning, the USSR is divided into a total of 15 geographically defined economic regions. This definition serves no other purpose and has no political or administrative significance.

DEFINITION OF SINO-SOVIET BLOC

As used in this report the term Soviet Bloc or Sino-Soviet Bloc is defined as including the following countries:

Albania	North Korea
Bulgaria	North Vietnam
Communist China	Outer Mongolia
Czechoslovakia	Poland
East Germany	Rumania
Hungary	Union of Soviet Socialist Republics (USSR)

FOREWORD

For this report it was necessary for the Committee to rely heavily on USSR published statistics and comments. This involved sifting of a large amount of data in an attempt to find that which was most authoritative, accurate, and reasonable. The data that your Committee chose to use and evaluate are included in this Volume. Some information was collected that did not, when the study was completed, seem to have a direct bearing on the results of the study. It was nevertheless included if it appeared that it might be of benefit to those using this Volume for supplementary studies. Numerous references are given throughout so the original source may be consulted if desired.

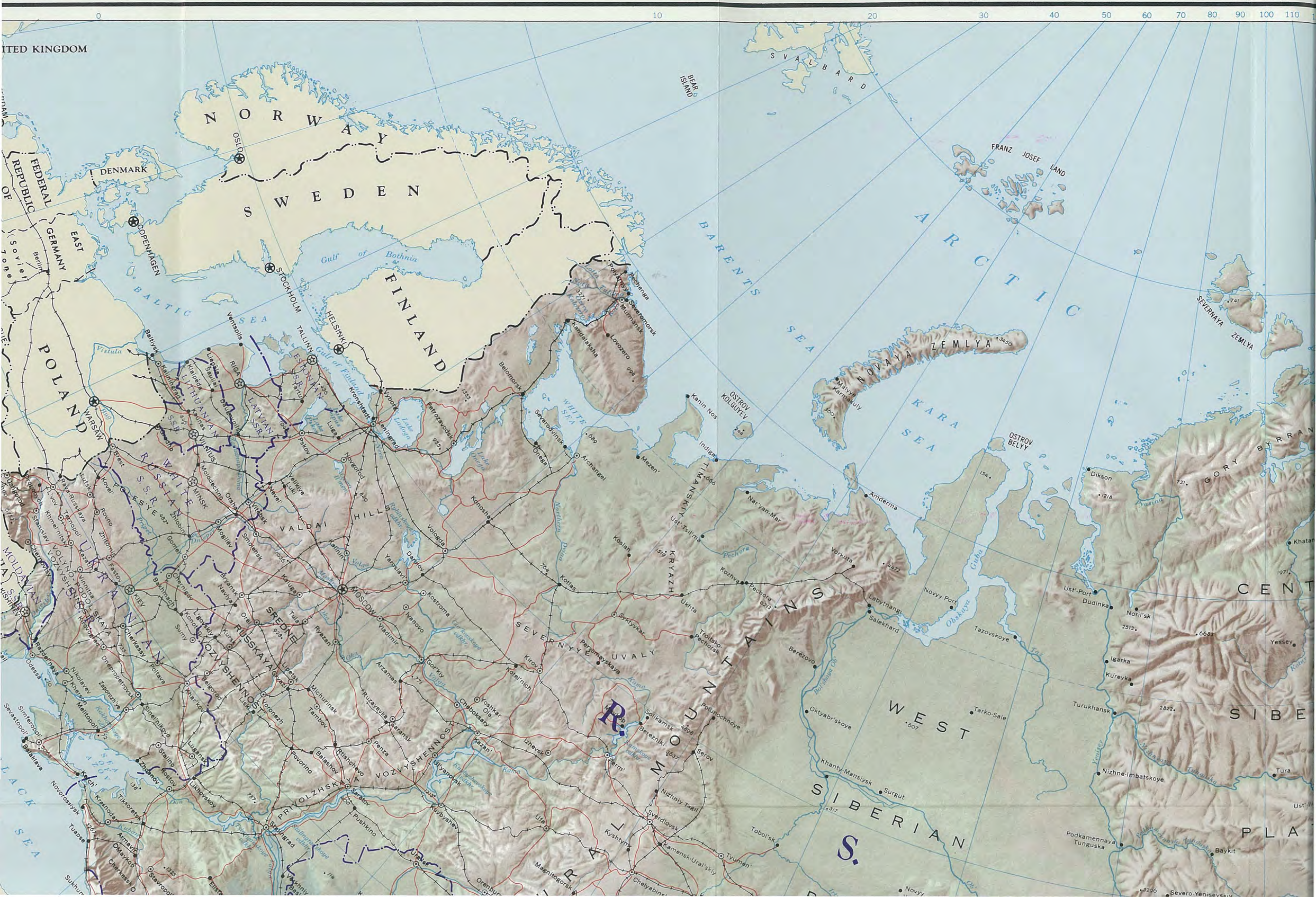
The Committee believes it should be obvious which facts are from reports of the USSR and other Bloc nations, and which are calculations and conclusions of the Committee. Nevertheless it might be well to point out that the Committee has tried to consistently use the word "planned" to denote an official plan of the USSR (or other Bloc nations), and the word "estimate" to refer to a calculation made by the Committee.

One final word of caution: Some of the statistics (particularly cost data) may appear questionable in the light of difficulties in arriving at comparable data for the U. S. However, it must be recognized that in some cases certain data may be more readily fixed in planned and arbitrary economy. Obviously the Committee had no way of checking Soviet statistics except to judge them on the basis of consistency within Soviet publications.

Where there are known significant omissions in the USSR cost allocations these have been pointed out.

The Committee wishes to emphasize that even though it recognizes inaccuracies in some of the cost data reported by the USSR, a very important aspect is that these data are apparently used by official planners and operators in decision making. In many ways it is the data they use, rather than what is actually true, which is more significant. Furthermore, it should be noted that the actual cost of production or the Soviet estimates thereof, is not the true factor in the selling price of petroleum to the Free World. The Soviet economic system permits the establishment of selling prices at any level believed desirable to meet economic and political requirements.

The cut-off date for most of the data included in this Volume was June 1, 1962, except for Section 50--Soviet Bloc Marine Activities--where the data have been brought up to September 1, 1962 because such data were readily available and reflected significant changes. Since June 1, 1962, the USSR has published various statistics, particularly its official trade statistics for 1961, which have not been included in this report. The Committee has reviewed the newly acquired data and believes that they do not alter its conclusions.



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NORWAY
OSLO
SWEDEN
DENMARK
COPENHAGEN
STOCKHOLM
FEDERAL REPUBLIC OF
EAST GERMANY
FINLAND
HELSINKI
TALLINN
Gulf of Bothnia
Gulf of Finland
BALTIC SEA
POLAND
WARSAW
LITHUANIAN S.S.R.
LATVIAN S.S.R.
WHITE RUSSIAN S.S.R.
UKRAINIAN S.S.R.
KIEV
MINSK
MOSCOW
Leningrad
VALDAI HILLS
SREDNE RUSSKAYA VOZVYSHENNOST
PRIVOLZHSKAYA VOZVYSHENNOST
SEVERNYYE UVALY
TIMANSKIY KRYAZH
URAL MOUNTAINS
WEST SIBERIAN
BARENTS SEA
WHITE SEA
KARA SEA
ARCTIC
SVALBARD
BEAR ISLAND
FRANZ JOSEF LAND
NOVAYA ZEMLYA
SEVERNAYA ZEMLYA
OSTROV KOLGUYEV
OSTROV BELYY
Kanin Nos
Murmansk
Archangel
Vorkuta
Pechora
Dikson
Noril'sk
Dudinka
Igarka
Salekhard
Labytnangi
Sverdlovsk
Chelyabinsk
Perm'
Kazan'
Gor'kiy
Kuybyshev
Saratov
Stalingrad
Rostov
Odessa
Kharkov
Tyumen'
Tobol'sk
Khanty-Mansiysk
Surgut
Turukhansk
Tura
Baykit
CENT
SIBE
PLA
R.
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ALASKA
JOSEF LAND
SEVERNAYA ZEMLYA
NEW SIBERIAN ISLANDS
LYAKHOVSKIYE OSTROVA
WRANGEL ISLAND
OCEAN
LAPTEV SEA
EAST SIBERIAN SEA
BERING SEA
SEA OF OKHOTSK
ZALIV SHELEKHOVA
KOMANDORSKIYE OSTROVA
CHUKOTSKOYE NAGORYE
KOLYMSKIY
KORYAKSKIY KHREBET
SREDINNYY KHREBET
KHREBET CHERSKOGO
YANSKIY KHREBET
VERKHOYANSKIY KHREBET
GORY BYRRANGA
CENTRAL SIBERIAN PLATEAU
DZHUGDZHUR
OSTROV BELYY
Dikson
Nordvik
Khatanga
Trofimovsk
Tiksi
Bulun
Kharstan
Kazach'ye
Allaykha
Druzhina
Ambarchik
Nizhne-Kolymsk
Sredne-Kolymsk
Zyryanka
Pevek
Ust'-Chaun
Vankarem
Uelen
Provideniya
Anadyr'
Markovo
Beringovskiy
Penzhino
Kamenskoye
Gizhiga
Korf
Il'pyrskiy
Seymchan
Magadan
Yagodnoye
Ust'-Nera
Oymyakon
Verkhoyansk
Batagay
Zhigansk
Sangar
Yakutsk
Pokrovsk
Amga
Ust'-Maya
El'dikan
Allakh-Yun'
Yur
Okhotsk
Inya
Tauysk
Khanyangda
Nel'kan
Ayan
Chagda
Tommot
Aldan
Dzhekonda
Nimnyrskiy
Olëkminsk
Nyuya
Peleduy
Suntar
Vilyuysk
Olenëk
Yessey
Noril'sk
Dudinka
Ust'-Port
Igarka
Kureyka
Turukhansk
Tura
Nizhne-Imbatskoye
Ust'-Ilimpeya
Podkamennaya Tunguska
Baykit
Yerbogachen
Severo-Yeniseyskiy
Tigil'
Ust'-Kamchatsk
Klyuchi
Mil'kovo
Petropavlovsk
Kirovskiy
Ust'-Bol'sheretsk
Ozernovskiy
Severo-Kuril'sk
Okha
R.


BLACK SEA
SEA OF AZOV
CASPIAN SEA
ARAL SEA
Lake Balkhash
TURKEY
IRAQ
IRAN
TEHERAN
AFGHANISTAN
PAK.
JAMMU AND KASHMIR
CHINA
MONG
WEST SIBERIAN PLAIN
URAL MOUNTAINS
PRIVOLZHSKAYA VOZVYSHENNOST'
PRIKASPIYSKAYA NIZMENNOST'
CAUCASUS
KAZAKH S.S.R.
KAZAKHSKAYA MELKOSOPOCHNIK
PLATO USTYURT
TURANSKAYA NIZMENNOST'
TURKMEN S.S.R.
PESKI KARAKUMY
UZBEK S.S.R.
PESKI KYZYL-KUM
TIEN SHAN
KIRGIZ S.S.R.
TADZHIK S.S.R.
PAMIRS
ALTAI
ZAPADNYY SAYAN
VOSTOCHNYY SAYAN
S. F.
Stalingrad
Saratov
Kazan'
Sverdlovsk
Chelyabinsk
Magnitogorsk
Orenburg
Omsk
Novosibirsk
Tomsk
Krasnoyarsk
Barnaul
Semipalatinsk
Karaganda
Akmolinsk
Pavlodar
Petropavlovsk
Kustanay
Aktyubinsk
Ural'sk
Gur'yev
Astrakhan'
Baku
Tbilisi
Yerevan
Makhachkala
Groznyy
Krasnovodsk
Ashkhabad
Bukhara
Samarkand
Tashkent
Stalinabad
Frunze
Alma-Ata
Dzhambul
Chimkent
Kzyl-Orda
Aral'sk
Nukus
Urgench
Khiva
Chardzhou
Mary
Kushka
Termez
Khorog
Andizhan
Namangan
Fergana
Osh
Przheval'sk
Narym
Kolpashevo
Yeniseysk
Achinsk
Kansk
Tayshet
Abakan
Minusinsk
Biysk
Gorno-Altaysk
Ust'-Kamenogorsk
Leninogorsk
Zyryanovsk
Ayaguz
Taldy-Kurgan
Kounradskiy
Balkhash
Dzhezkazgan
Tobol'sk
Tyumen'
Kurgan
Tara
Ishim
Khanty-Mansiysk
Surgut
Podkamennaya Tunguska
Baykit
Nizhne-Imbatskoye
Severo-Yeniseyskiy
Ubsa Nuur
U.S.S
TR
Railroad
Principal road or route
Boundaries are not necessarily those recognized by the U.S. Government.
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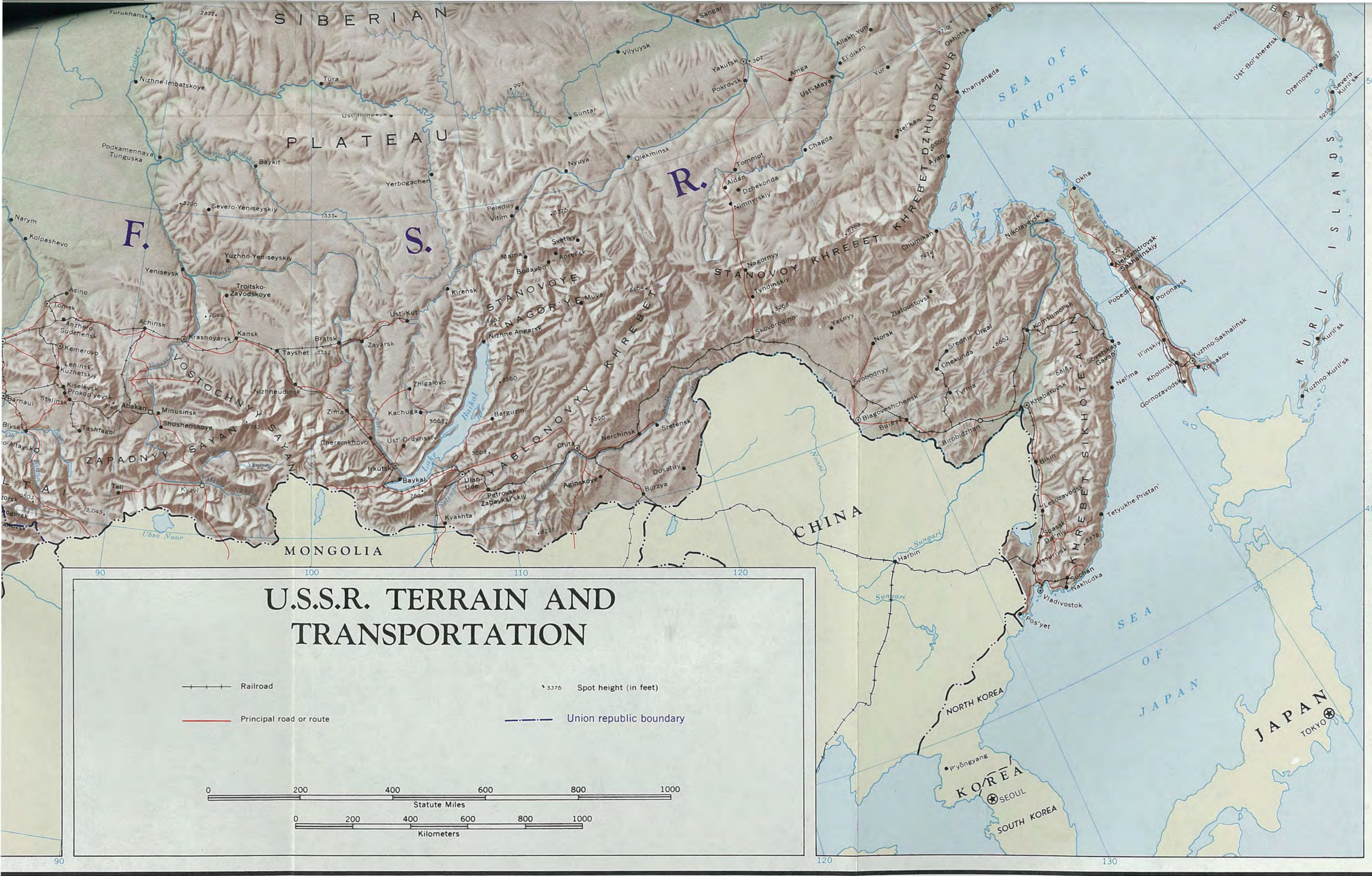


U.S.S.R. TERRAIN AND TRANSPORTATION

PART THREE

THE SOVIET UNION

CHAPTER I

ENERGY IN THE SOVIET UNION

CHAPTER I

ENERGY IN THE SOVIET UNION

SECTION I

PRODUCTION OF ENERGY

A. Historical and Planned

For the past several years, the Soviet Union has been in the process of executing a dramatic, forced shift in the structure of the primary energy balance of the country. Within this shift, emphasis is being placed on the expanded production of the more economical liquid and gaseous fuels. At the same time the more expensive and less satisfactory solid fuels have been allocated declining shares in the fuel balance, although in absolute terms, production of these fuels--coal, shale and peat--will continue to increase. This shift is shown on Table 1-1, which presents the reported production of energy in the USSR for 1950 and 1960, and compares this with the Committee's estimate of production for 1965 and with that planned by the USSR for 1970 and 1980. It will be noted that crude oil and natural gas supplied only 19 percent of the energy in the USSR in 1950, but by 1960 this share increased to 37.1 percent. Further, the USSR is forecasting that the participation in the overall energy picture of crude oil and natural gas will increase to 60.6 percent in 1970 and to 62.8 percent in 1980.

The reason for this shift is primarily economic in nature, although the strategic implications are obvious as well. The strategic value lies in the fact that the fuel-consuming economy of the Soviet Union will no longer be heavily dependent upon a single source of fuel. Expanded transportation facilities, particularly pipelines, will be concomitant with production increases. Thus no single carrier will be given the task of fuel distribution. A degree of flexibility, within limits, will be achieved, as large consumers of energy, for example certain of the electric power stations, will be equipped to burn either natural gas or residual fuel oil.

TABLE 1-1

REPORTED, ESTIMATED AND PLANNED SHIFTS AMONG THE MAJOR SOURCES OF PRIMARY ENERGY IN THE USSR
1950, 1960, 1965 ESTIMATE AND PLANS FOR 1970 AND 1980

SOURCE OF ENERGY	UNIT OF NATURAL MEASURE*	1950			1960			1965 COMMITTEE ESTIMATE			1970 PLAN			1980 PLAN		
		NATURAL UNITS a/	MMTSF**	PERCENT OF TOTAL	NATURAL UNITS a/	MMTSF**	PERCENT OF TOTAL	NATURAL UNITS a/	MMTSF**	PERCENT OF TOTAL	NATURAL UNITS a/	MMTSF**	PERCENT OF TOTAL	NATURAL UNITS a/	MMTSF**	PERCENT OF TOTAL
Coal	MMT	261.1	205.7	64.6	513.2	373.1	52.1	565.0	423.8	39.6	686-700	540.5	34.9	1,180-1,200	928.2	31.6
Crude Oil	MMT	37.9	54.2	17.0	147.9	211.5	29.5	265.0	379.0	35.5	390	557.7	36.0	690-710	1,001.0	34.2
Natural Gas	BCM	5.8	7.3	2.3	45.3	54.4	7.6	135.0	162.0	15.2	310-325	381.0	24.6	680-720	840.0	28.6
Hydroelectric	BKWH	12.7	7.3	2.3	50.9	23.9	3.3	90.0	41.0	3.8	190	68.4	4.5	570	165.3	5.6
Nuclear	BKWH	- b/	-	-	Negl. b/	Negl.	-	6.6 b/	3.0	0.3	- c/	- c/	-	c/	c/	-
SUB-TOTAL			274.5	86.2		662.9	92.5		1,008.8	94.4		1,547.6	100.0		2,934.5	100.0
Peat	MMT	36.0 d/	14.8	4.6	53.6 d/	20.4	2.8	e/	27.0	2.5	NA	NA	NA	NA	NA	NA
Shale	MMT	4.7 d/	1.3	0.4	14.1 d/	4.8	0.7	e/	7.5	0.7	NA	NA	NA	NA	NA	NA
Fuelwood	BCM	f/	27.9 g/	8.8	f/	28.7 g/	4.0	f/	25.7	2.4	NA	NA	NA	NA	NA	NA
TOTAL			318.5	100.0		716.8	100.0		1,069.0	100.0		NA	-		NA	-

NA = Data not available.
*MMT = Million Metric Tons.
BCM = Billion Cubic Meters.
BKWH = Billion Kilowatt-Hours.
**MMTSF = Million Metric Tons of Standard Fuel. One metric ton of standard fuel has a calorific value of 7,000,000 kilocalories or 27,780,000 BTU's.
a/ Except where noted, data have been derived from Soviet statistics and Committee estimates given in the appropriate sections of this report dealing with production of the fuels in question.
b/ Committee estimate.
c/ Not available, but as a percent of the total may be considered as insignificant.
d/ 1/
e/ Based on 1965 plan.
f/ Not calculated.
g/ 2/

Perhaps of equal importance to the Soviet Union are the economic benefits which are to accrue from this shift. The Committee believes these benefits may include, among others:

(a) Reduced labor input per unit of standard fuel produced;

(b) Reduced capital investment per unit of new producing capacity added;

(c) Lower transportation costs per unit of standard fuel incurred in the movement from the place of production to the consumer;

(d) Comparatively more producing capacity to be added in a shorter period of time;

(e) Opportunity for introduction of automation on a wider scale in the energy economy;

(f) Reduced cost of production per unit of output of standard fuel;

(g) Higher heat content per unit of fuel produced and probably greater burning efficiency.

B. Labor Input

The reduction in the input of labor per unit of standard fuel produced apparently is of considerable importance to the Soviet planners and much attention has been given to the ultimate benefits the shift in the energy balance will produce in this direction. During the Seven Year Plan (1959-65), labor input per one ton of standard fuel produced is to decline by 0.284 man-days, which is to result in a savings in 1965 alone of about 291 million man-days. Derivation of this savings is illustrated in Table 1-2.

TABLE 1-2

WEIGHTED AVERAGE MAN-DAYS PER ONE TON OF STANDARD FUEL PRODUCED IN THE USSR* - 1958 AND 1965

		1958		1965	
SOURCE OF ENERGY	MAN-DAYS PER TON OF STANDARD FUEL** a/	SHARE OF ENERGY BALANCE (PERCENT) b/	WEIGHTED MAN-DAYS PER TON OF STANDARD FUEL**	SHARE OF ENERGY BALANCE (PERCENT) b/	WEIGHTED MAN-DAYS PER TON OF STANDARD FUEL**
Coal	0.917	58.7	0.538	41.3	0.379
Crude Oil	0.234	26.3	0.062	37.0	0.087
Natural Gas	0.066	5.5	0.004	15.8	0.010
Peat	2.237	3.4	0.076	2.6	0.058
Shale	1.559	0.7	0.011	0.7	0.011
Fuelwood	5.000	5.4	0.263	2.6	0.125
TOTAL		100.0	0.954	100.0	0.670

* Excluding hydroelectric power and nuclear power.

** One metric ton of standard fuel has a calorific value of 7,000,000 kilocalories or 27,780,000 BTU's.

a/ 3/

b/ Derived from Table 1-1.

The approximate number of workers engaged in 1958 in producing petroleum, coal, peat and wood were:

Crude Oil	69,200*
Natural Gas	4,250*
Coal	1,000,000
Peat	100,000
Wood	600,000

* Excludes those workers in exploration and drilling.

C. Cost of Energy

The shift from the expensive solid fuels to the relatively cheap crude oil and natural gas will effect a decline of considerable significance in the weighted average cost of production of primary energy in the Soviet Union.

As shown in Table 1-3, it is estimated that the weighted average cost of production of primary energy in the Soviet Union in 1965 will be about 5.47 rubles per ton of standard fuel, compared with 8.66 rubles per ton of standard fuel in 1958, or a decline of more than one-third. This decline, if achieved, will represent a savings of more than 3.5 billion rubles in terms of cost of production alone in 1965.

D. Past Performance Compared With Plan

When the original theses of the Seven Year Plan were published, planned annual production goals for each of these fuels during the years 1959-65 were not given; the statement limited itself to the announced ranges of production for 1965.

Following publication of these theses, information became available on planned coal production for each of the years 1959-65 and on so-called production control figures for crude oil for 1959-61. For natural gas, only those production goals for the coming year have been published.

Of the three major sources of energy in the Soviet Union--coal, crude oil and natural gas--only crude oil has

TABLE 1-3

COMPARISON OF WEIGHTED AVERAGE COSTS OF PRIMARY ENERGY* IN THE USSR - 1958 AND 1965

PRIMARY ENERGY	1958 COST OF PRODUCTION (RUBLES/ MTSF**)	1958 SHARE OF ENERGY BALANCE a/ (PERCENT)	1958 WEIGHTED AVERAGE COST OF PRODUCTION (RUBLES/ MTSF**)	1965 COST OF PRODUCTION (RUBLES/ MTSF**)	1965 SHARE OF ENERGY BALANCE a/ (PERCENT)	1965 WEIGHTED AVERAGE COST OF PRODUCTION (RUBLES/ MTSF**)
Coal	10.74 b/	58.7	6.30	9.20	41.3	3.80
Crude Oil	2.42 c/	26.3	0.64	1.88	37.0	0.70
Natural Gas	0.60 d/	5.5	0.03	0.23	15.8	0.04
Peat	8.65 e/	3.4	0.29	8.65 e/	2.6	0.22
Shale	14.83 e/	0.7	0.10	14.83 e/	0.7	0.10
Fuelwood	24.50 e/	5.4	1.30	24.50 e/	2.6	0.61
TOTAL	-	100.0	8.66	-	100.0	5.47

* Excluding hydroelectric and nuclear power.

** MTSF = Metric Tons of Standard Fuel. One metric ton of standard fuel has a calorific value of 7,000,000 kilocalories or 27,780,000 BTU's.

a/ Derived from Table 1-1.

b/ Derived from Table 2-7.

c/ Derived from Table 3-25.

d/ Derived from Table 3-37.

e/ 4/

been produced in quantities sufficient to meet the annual goals during the first three years of the Seven Year Plan, as shown in the following tabulation:

SOURCE OF ENERGY	UNIT OF MEASURE	1959 PLAN	1959 ACTUAL	1960 PLAN	1960 ACTUAL	1961 PLAN	1961 ACTUAL
Coal	Million Tons	500.5*	506.5*	515.2	513.0	511.7	510.0
Crude Oil	Million Tons	128.0**	129.6	144.3**	147.9	161.0**	166.0
Natural Gas	Billion Cubic Meters	39.3	35.4	51.1	45.3	61.3	59.0

* Although coal production in 1959 was 6 million tons in excess of the revised goal for that year, the revised goal called for 12 million tons less of coal than originally had been planned for the first year of the Seven Year Plan. Therefore, the 1959 level of coal production must be considered as plan under fulfillment in terms of meeting the 1965 goal.

** So-called control figures as part of the Seven Year Plan and as such are not necessarily the accepted plan goal for the year in question. Rather, these were provisional goals established as part of the program to achieve a production level of 230-240 million tons by 1965.

Cumulative below-plan production of coal and natural gas during 1959-61 totalled 22 million tons of standard fuel. At the same time, cumulative above-plan production of crude oil totalled 14.6 million tons of standard fuel, sufficient to offset about two-thirds of the shortfall in coal and natural gas. Thus, by the end of 1961, cumulative production of coal, crude oil and natural gas was 7.4 million tons of standard fuel less than what had been planned for the first three years (1959-61) of the Seven Year Plan.

E. Estimate of Production for 1965

The original goals for production of coal, crude oil and natural gas for 1965 were established by the Seven Year Plan as follows:

SOURCE	UNIT OF MEASURE	GOAL
Coal	Million Metric Tons	606-612
Crude Oil	Million Metric Tons	230-240
Natural Gas	Billion Cubic Meters	148.3

Of these original goals, only that for crude oil has been revised. The accepted official goal for production of crude oil in 1965 is now 240 million tons. Despite the inability of both the coal and natural gas industries to meet any of the production goals for the first three years of the Seven Year Plan, Soviet authorities, publicly at least, have not deemed it necessary to make any official downward revisions in the 1965 production goals for these fuels.

Nevertheless, it seems unlikely that production of coal and natural gas in 1965 will be sufficient to reach the original planned levels. The Committee estimates that the production of coal in 1965 will be on the order of 565 million tons (about 92 percent of plan) and the output of natural gas will reach to no more than 135 billion cubic meters (91 percent of plan).

On the other hand, the production of crude oil in 1965 may reach to as much as 265 million tons, or 25 million tons (10 percent) in excess of plan.

Thus, the amount of primary energy provided by coal, crude oil and natural gas in 1965, as estimated by the Committee, will represent a deficit of about 15 million tons of standard fuel, as compared with the planned level of output:

	(MILLION METRIC TONS STANDARD FUEL)	
SOURCE OF ENERGY	COMMITTEE ESTIMATE	SOVIET PLAN
Coal	423.8	459.0
Crude Oil	379.0	343.2
Natural Gas	162.0	178.0
TOTAL	964.8	980.2

The Committee further believes that this deficiency, which is equivalent to about 1.5 percent of the planned production in 1965, will be of no consequence to the Soviet economy, except that certain isolated geographic areas of the USSR may be provided with less fuel than originally planned.

SECTION 2

CONSUMPTION OF ENERGY

A. Soviet Published Data

Other than for only a very generalized description of consumption of primary energy in the USSR by consumer, little satisfaction can be obtained in an attempt to develop consumption data by means of reviewing current Soviet literature. It has been the approach of Soviet planners to exclude light petroleum products--gasoline, kerosine, light diesel fuel and lubricants--from the energy consumption balances. The reasons for this exclusion are not clear and although the deficiencies in this approach are quite obvious to the Soviet authorities, there presently is no indication that in the future the consumption balances will embrace all petroleum products. The light petroleum products are considered independently in a separate fuel balance. This balance is not published in the open literature. In addition, in the consumption balance, only those quantities of natural gas which are consumed in so-called productive-exploitational processes, which exclude use as a raw material in the chemical industry, are included.

The consumption balances presented in Table 1-4 are typical of those published in the Soviet literature. These balances, by virtue of exclusion of light petroleum products, over-emphasize the role of coal in the energy-consuming economy of the country and, conversely, underplay the importance of petroleum products.

Soviet authorities have estimated that the total consumption of primary and secondary energy in 1965 would reach 830 million tons of standard fuel for an increase of 63.9 percent compared with 1958. Of this total, 775 million tons would be provided by primary energy, but again light petroleum products were excluded. Such secondary energy sources as coke-oven gas, blast furnace gas, refinery gas and coke fines would provide an additional 50 to 55 million tons, for a total of 830 million tons. (Such secondary sources provided 42.8 million tons of energy in 1958.)

The distribution of the consumption of all energy by economic regions of the Soviet Union in 1958 and 1965 is given in Table 1-5.

TABLE 1-4

CONSUMPTION OF PRIMARY ENERGY IN THE USSR, AS PRESENTED BY SOVIET PUBLICATIONS a/
1958 AND 1965

TYPE OF FUEL	1958 MILLION METRIC TONS OF STANDARD FUEL	1958 PERCENT OF TOTAL	1965 MILLION METRIC TONS OF STANDARD FUEL	1965 PERCENT OF TOTAL
Coal	362.2	74.4	446.4	57.6
Petroleum Fuel b/	49.8	10.2	113.7	14.7
Natural Gas c/	30.3	6.2	166.0	21.4
Peat	19.1	3.9	22.8	2.9
Shale	3.9	0.8	7.4	1.0
Fuelwood d/	21.9	4.5	18.7	2.4
TOTAL	487.2 e/	100.0	775.0 e/	100.0

a/ 1/
b/ Excludes light petroleum products.
c/ Excludes those volumes of natural gas used as a raw material by the chemical industry.
d/ Excludes those quantities of fuelwood gathered by the population and those quantities consumed for non-fuel needs.
e/ Use of secondary fuels-energy resources of industry added 42.8 million tons to this total in 1958 and will add about 55 million tons in 1965 2/. These sources include, among others: Coke-oven gas, blast furnace gas, refinery gas and coke fines. Of the latter quantity, about 40 to 45 million tons will be used for the generation of steam, hot water and electric power.

TABLE 1-5

REGIONAL GROWTH IN THE CONSUMPTION OF ALL ENERGY
IN THE USSR, AS PLANNED BY SOVIET AUTHORITIES a/
(EXCLUDING LIGHT PETROLEUM PRODUCTS)
1958 AND 1965

ECONOMIC REGION		1958			1965		
NUMBER	NAME	PERCENT	MMTSF*	PERCENT NATIONAL	PERCENT	MMTSF*	PERCENT NATIONAL
I	Soviet North	10.1	34.3	6.5	10.5	51.4	6.2
II	West	5.0	17.0	3.2	4.9	24.0	2.9
III	South	36.9	125.5	23.7	36.7	179.8	21.7
IV	North Caucasus	5.4	18.4	3.5	5.4	26.5	3.2
V	Transcaucasus	4.0	13.6	2.6	5.3	26.0	3.1
VI	Volga	7.1	24.1	4.5	6.8	33.3	4.0
VII	Center	31.5	107.1	20.2	30.4	149.0	18.0
	TOTAL EUROPEAN USSR**	100.0	340.0	64.1	100.0	490.0	59.0
Xa	Kazakhstan	17.0	17.0	3.2	18.9	37.8	4.6
Xb	Central Asian Republics	10.1	10.1	1.9	12.3	24.6	3.0
IX	West Siberia	30.9	30.9	5.8	29.5	59.0	7.1
XI	East Siberia	23.4	23.4	4.4	25.8	51.6	6.2
XII	Far East	18.6	18.6	3.5	13.5	27.0	3.3
	TOTAL EASTERN REGIONS**	100.0	100.0	18.9	100.0	200.0	24.1
VIII	Urals	-	90.0	17.0	-	140.0	16.9
	NATIONAL TOTAL	-	530.0	100.0	-	830.0	100.0

* MMTSF = Million Metric Tons of Standard Fuel.
** Totals derived independently and may not always agree with the sum of the components.
a/ 3/

Although the consumption balances which have been described are lacking in certain respects, they do present within limits a generalization of the regional distribution of consumption of energy in the USSR in 1965, as envisaged by Soviet planning experts and, therefore, are of value as aids in permitting some basis for analysis of inter-regional energy production and consumption.

It will be noted that by 1965 the eastern regions (Kazakhstan and Central Asia, Siberia, and the Far East) will consume a significantly greater percentage of the entire Soviet total and European USSR will consume a lesser part than in 1958, reflecting the results of planned industrial development in this area.

These projections show that the area comprising the Ukrainian and Moldavian Republics accounts for more consumption of fuel--an estimated 21.7 percent in 1965--than any other area. The second most important consuming area is the so-called "Center" or Economic Region VII, with the Moscow industrial complex as its focal point. This area accounts for about one-fifth of total fuel consumed in the Soviet Union. The Urals is the third most important area; it consumes about one-sixth of the nation's total energy, and its share is to remain constant during the Seven Year Plan. Together, the Ukraine, the Center and the Urals are to account for almost 57 percent of total fuel consumed in 1965.

As a matter of interest, the several economic regions of the USSR are grouped into three major geographic areas and the consumption of fuel in these areas has been broken down according to type of fuel. These consumption patterns, shown in Table 1-6, highlight the anticipated growth in the use of natural gas, particularly in the European USSR and in the Urals.

One striking aspect of the above balances is the very low projected consumption of petroleum fuel (primarily residual fuel oil and heavy diesel fuel) in the eastern regions of the country, which in essence covers all of the land mass east of the Ural Mountains. Requirements for petroleum fuel in the eastern regions in 1965, converted to natural units, are in the order of about 14 million tons.

TABLE 1-6

CONSUMPTION OF FUEL IN THE USSR, BY MAJOR GEOGRAPHIC AREA AND BY TYPE OF FUEL a/ - 1958 AND 1965

REGION AND FUEL	1958 MILLION METRIC TONS OF STANDARD FUEL	1958 PERCENT OF TOTAL	1965 MILLION METRIC TONS OF STANDARD FUEL	1965 PERCENT OF TOTAL
EUROPEAN USSR				
Coal	231.8	68.2	250.4	51.1
Petroleum Fuel b/	37.1	10.9	74.1	15.1
Natural Gas	32.3	9.5	122.5	25.0
Other	38.8	11.4	43.0	8.8
TOTAL	340.0	100.0	490.0	100.0
URALS				
Coal	72.7	80.8	64.4	46.0
Petroleum Fuel b/	10.2	11.3	31.4	22.4
Natural Gas	0.7	0.8	38.2	27.3
Other	6.4	7.1	6.0	4.3
TOTAL	90.0	100.0	140.0	100.0
EASTERN REGIONS				
Coal	86.3	86.3	157.0	78.5
Petroleum Fuel b/	7.8	7.8	19.4	9.7
Natural Gas	0.9	0.9	16.0	8.0
Other	5.0	5.0	7.6	3.8
TOTAL	100.0	100.0	200.0	100.0
GRAND TOTAL	530.0	-	830.0	-

a/ 4/
b/ Excludes light petroleum products.

B. Estimates of Total Soviet Energy Consumption

As previously stated, the above energy consumption figures as reported by the USSR do not include all primary energy. Table 1-7 gives complete energy production, consumption and export balances for the years 1958-62, and revised projections for 1965 based on latest information. These figures now include light petroleum products, which were excluded in the Soviet planned figures previously discussed.

The estimated energy consumption pattern for the USSR in 1965 as given in Table 1-7 was constructed from the best current predictions of 1965 energy production, an estimate of petroleum consumption in that year, and certain reasonable assumptions which can be made concerning the exports of other energy sources. Thus, estimates for 1965 in this table were obtained as follows:

(a) Estimated energy production is that shown previously in Table 1-1.

(b) Consumption of hydroelectric, nuclear, peat, shale and firewood energies is equated to production.

(c) On the basis of recent trends, the relatively small net exports of coal and natural gas are assumed to be 14.9 million tons and 300 million cubic meters respectively.

(d) Consumption of petroleum (including refinery gas and loss) is estimated to be 200 million tons in 1965. This estimate is derived from the recent trend of growth in petroleum consumption with industrial production, as discussed elsewhere in this report.

The total energy demand is a function of the industrial output of the country and of the efficiency of energy utilization to achieve this output. The total 1965 energy demand shown in Table 1-7 has been checked for consistency within the framework of announced Soviet industrial plans. Figure No. 1 shows the historical relationship between apparent energy consumption and an Index of Industrial Production in the USSR for the years 1950 through 1961. The Index used on this graph

TABLE 1-7

PRIMARY ENERGY: ESTIMATED PRODUCTION, NET TRADE AND APPARENT CONSUMPTION IN THE USSR
1958-1962 AND 1965
(Million Metric Tons)

YEAR	SOURCE OF ENERGY	PRODUCTION a/ (STANDARD FUEL)	PRODUCTION a/ (PERCENT OF TOTAL)	NET TRADE b/ c/ (STANDARD FUEL)	NET TRADE b/ c/ (PERCENT OF TOTAL)	APPARENT CONSUMPTION d/ (STANDARD FUEL)	APPARENT CONSUMPTION d/ (PERCENT OF TOTAL)
1958	Coal	362.1	56.7	-6.2	23.2	355.9	58.2
	Liquid Petroleum	161.9	25.3	-20.3	76.0	141.6	23.1
	Natural Gas	33.9	5.3	-0.2	0.8	33.7	5.5
	Peat	21.1	3.3	0	0	21.1	3.4
	Shale	4.5	0.7	0	0	4.5	0.7
	Fuelwood	32.9	5.2	0	0	32.9	5.4
	Hydroelectric Power	22.3	3.5	0	0	22.3	3.7
	Nuclear Electric Power	Negl. e/	Negl.	0	0	Negl.	Negl.
	TOTAL	638.7	100.0	-26.7	100.0	612.0	100.0
1959	Coal	370.0	54.3	-6.7	18.9	363.3	56.3
	Liquid Petroleum	185.3	27.2	-28.6	80.6	156.7	24.3
	Natural Gas	42.5	6.2	-0.2	0.5	42.3	6.5
	Peat	23.0	3.4	0	0	23.0	3.6
	Shale	4.6	0.7	0	0	4.6	0.7
	Fuelwood	34.0	5.0	0	0	34.0	5.3
	Hydroelectric Power	21.8	3.2	0	0	21.8	3.3
	Nuclear Electric Power (Est.)	Negl. e/	Negl.	0	0	Negl.	Negl.
	TOTAL	681.2	100.0	-35.5	100.0	645.7	100.0
1960	Coal	373.1	52.1	-7.4	-15.1	365.7	54.8
	Liquid Petroleum	211.5	29.5	-41.5	84.5	170.0	25.5
	Natural Gas	54.4	7.6	-0.2	0.4	54.2	8.1
	Peat	20.4	2.8	0	0	20.4	3.1
	Shale	4.8	0.7	0	0	4.8	0.7
	Fuelwood	28.7	4.0	0	0	28.7	4.3
	Hydroelectric Power (Est.)	23.9	3.3	0	0	23.9	3.5
	Nuclear Electric Power	Negl. e/	Negl.	0	0	Negl.	Negl.
	TOTAL	716.8	100.0	-49.1	100.0	667.7	100.0
1961	Coal	372.3	48.8	-7.7	13.1	364.6	51.8
	Liquid Petroleum	237.4	31.1	-50.9	86.3	186.5	26.5
	Natural Gas	70.8	9.3	-0.4	0.6	70.4	10.0
	Peat	21.7 e/	2.8	0	0	21.7	3.1
	Shale	5.0 e/	0.7	0	0	5.0	0.7
	Fuelwood	28.7 e/	3.8	0	0	28.7	4.1
	Hydroelectric Power	26.7	3.5	0	0	26.7	3.8
	Nuclear Electric Power	Negl. e/	Negl.	0	0	Negl.	Negl.
	TOTAL	762.6	100.0	-59.0	100.0	703.6	100.0
1962	Coal	382.1	46.5	-8.5	11.6	373.6	49.9
	Liquid Petroleum	268.8	32.7	-64.3	87.8	204.5	27.3
	Natural Gas	84.6	10.3	-0.4	0.6	84.2	11.3
	Peat	23.0 e/	2.8	0	0	23.0	3.1
	Shale	5.6 e/	0.7	0	0	5.6	0.7
	Fuelwood	28.0 e/	3.4	0	0	28.0	3.7
	Hydroelectric Power	29.3	3.6	0	0	29.3	4.0
	Nuclear Electric Power	Negl. e/	Negl.	0	0	Negl.	Negl.
	TOTAL	821.4	100.0	-73.2	100.0	748.2	100.0
1965	Coal	423.8	39.6	-11.5	11.0	412.3	42.8
	Liquid Petroleum	379.0	35.5	-93.0 g/	88.7	286.0	29.7
	Natural Gas	162.0	15.2	-0.4	0.3	161.6	16.8
	Peat	27.0 f/	2.5	0	0	27.0	2.8
	Shale	7.5 f/	0.7	0	0	7.5	0.8
	Fuelwood	25.7 f/	2.4	0	0	25.7	2.7
	Hydroelectric Power	41.0	3.8	0	0	41.0	4.1
	Nuclear Electric Power	3.0 f/	0.3	0	0	3.0	0.3
	TOTAL	1,069.0	100.0	-104.9	100.0	964.1	100.0

a/ Except where noted, production data have been derived from Soviet statistics and Committee estimates given in the appropriate section of this report dealing with production of the fuel in question. Data on peat, shale and fuelwood for 1958-1960 have been derived from 5/.

b/ Net export balance designated by use of a minus (-) sign.

c/ 1958-1960 data from 6/. 1961, 1962 and 1965 have been estimated. Coke is included in the net trade figures for coal.

d/ By difference. Includes losses and processing requirements.

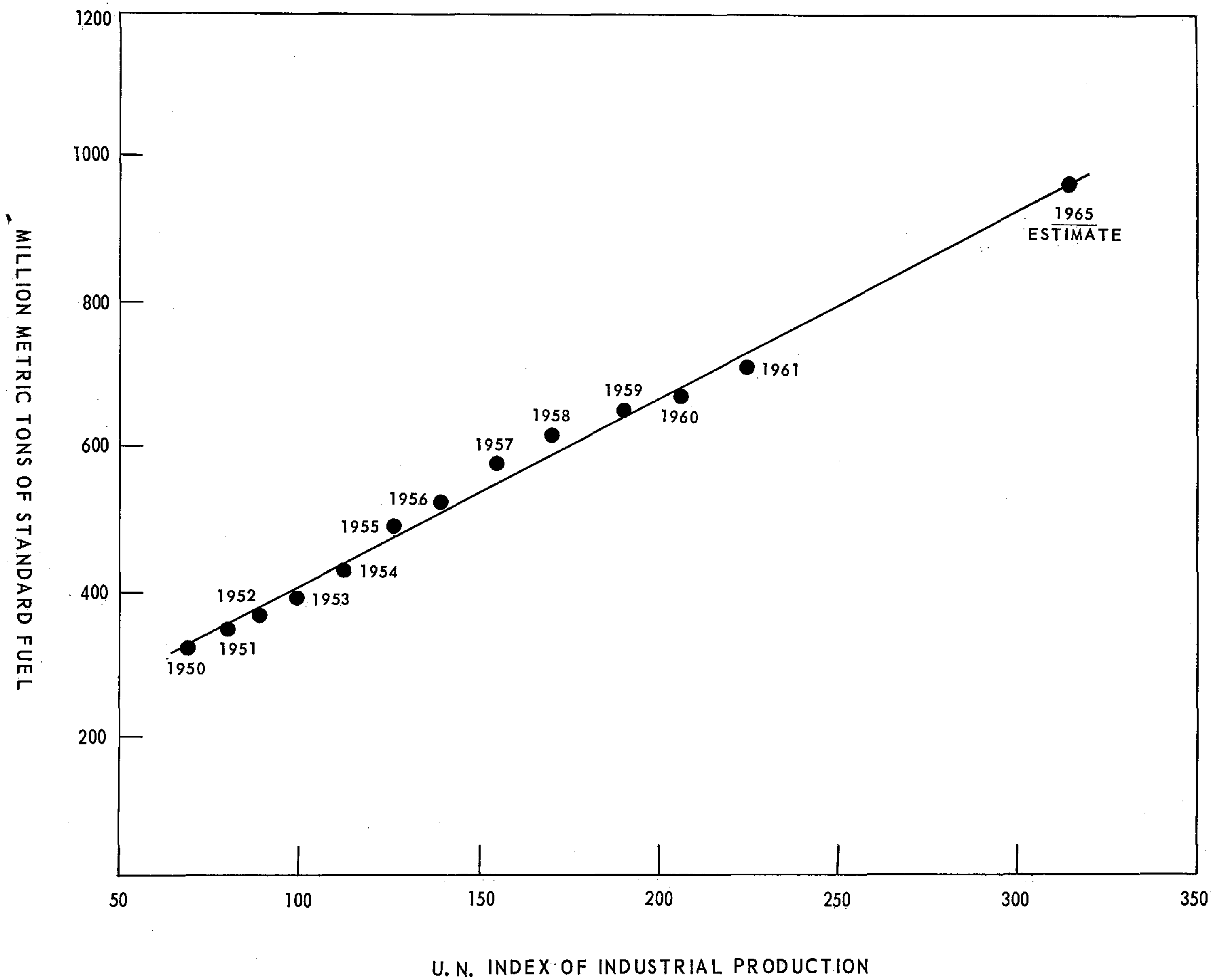
e/ Committee estimate.

f/ Derived from Table 1-1.

g/ Excluding natural gas liquids.

Figure No. 1

USSR APPARENT ENERGY CONSUMPTION - INDEX OF INDUSTRIAL PRODUCTION RELATIONSHIP, 1950 - 61 AND 1965 ESTIMATE



is that published by the U.N. in the Statistical Bulletins of September, 1957, and February, 1962. From these data a projection has been made to predict apparent energy consumption in 1965 at increasing indices of industrial production. The 1965 Index has been estimated at 314, based on an assumed annual increase in the U.N. Index of 8.7 percent. This rate of increase appears consistent with the trend in recent years and also is in line with Soviet statements that industrial production would increase by 60 percent during the current Seven Year Plan. Use of this rate of increase yields for 1965 a total energy requirement of 958 million tons of standare fuel for an Index of Industrial Production of 314. (See Table 1-8)

The inherent inaccuracies of this technique are obvious. For example, this approach postulates a 1965 industrial production and also implies that the growth rate for the efficiency of energy utilization in industrial production will be the same for the next 4 years as it has been on the average during the past 12 years. Actually, the efficiency of energy utilization may grow at a faster rate as total industrial output increases, as has occurred in other countries during periods of rapid industrialization. However, the requirement of 958 million tons of standard fuel as determined from this projection can be taken as a most reasonable confirmation of the 964.1 million tons consumption given in Table 1-7.

C. U.S.-USSR Per Capita Consumption of Energy

Total energy made available for consumption per capita in the U.S. in 1961 was almost three times those quantities made available per capita by the controlled, planned economy of the USSR. Although the fuels industry of the Soviet Union has been scheduled for particularly high rates of growth during the Seven Year Plan, Table 1-9 shows that the absolute gap between per capita energy consumption in the U.S. and in the USSR--in favor of the U.S. by 161.8 million BTU's in 1958--will have been reduced only slightly by 1965, to 155.6 million BTU's.

In terms of per capita consumption of petroleum, the USSR is in an even less favorable position. In 1961, per capita consumption of petroleum in the U.S. was more than four times that in the USSR. Even deduction of the very high automotive requirements for petroleum in the U.S. from petroleum consumption fails to show the USSR in a more favorable light. Their relative position will have been bettered somewhat by 1965, as very little change in petroleum consumption per capita in the US. is anticipated.

TABLE 1-8

USSR APPARENT ENERGY CONSUMPTION AND INDEX OF INDUSTRIAL PRODUCTION RELATIONSHIP, 1950-61 AND 1965 PROJECTION

YEAR	MMTSF*	INDEX OF INDUSTRIAL PRODUCTION
1950	321	69
1951	346	80
1952	366	89
1953	392	100
1954	428	113
1955	487	127
1956	520	140
1957	572	155
1958	612	171
1959	646	190
1960	668	206
1961	704	225
1965 Projection	958	314
MIDPOINTS FOR TREND LINE:		
1950	324	69
1955	474	127
1961	728	225

* MMTSF = Million Metric Tons of Standard Fuel.

TABLE 1-9

US - USSR PER CAPITA CONSUMPTION OF ENERGY AND OF PETROLEUM
1950 - 1961 AND 1965 ESTIMATE

	U S S R			UNITED STATES			
YEAR	MILLION POPULATION a/	TOTAL ENERGY (MILLION BTU'S/ CAPITA)	PETROLEUM (BBLS./CAPITA)	MILLION POPULATION b/	TOTAL ENERGY (MILLION BTU'S/ CAPITA)	PETROLEUM (BBLS./CAPITA)	PETROLEUM LESS AUTOMOTIVE FUELS (BBLS./CAPITA)
1950	181	49.3	1.6	151.2	229	15.7	9.4
1951	184	52.2	1.7	153.4	242	16.8	10.0
1952	187	54.4	1.9	155.8	236	17.1	10.2
1953	191	57.0	2.0	158.3	239	17.5	10.4
1954	194	61.3	2.1	161.2	228	17.6	10.3
1955	197	68.7	2.5	164.3	246	18.8	11.1
1956	200	72.2	2.9	167.3	251	19.2	11.4
1957	204	77.9	3.2	170.3	248	18.9	11.2
1958	207	82.2	3.5	173.2	244	19.1	11.3
1959	211	84.8	3.8	176.5	249	19.5	11.6
1960	215	86.4	4.1	180.0	253	19.7	11.6
1961	219	89.3	4.3	184.0	250	19.4	11.4
1965 Estimate	234	114.4	6.2	196.5	270	20.1	11.7

SECTION 3

NET TRADE

Data on the net trade of the USSR, by source of energy, for the years 1958-62 and that estimated for 1965 are presented in Table 1-7.

In 1958, the Soviet Union showed a net export of 26.7 million tons of standard fuel, or the equivalent of less than 4 percent of production. More than three-quarters of these exports were in the form of liquid petroleum. It is estimated that, in 1962, Soviet net exports of energy will increase to more than 73 million tons of standard fuel or about 9 percent of production, and by 1965--to about 105 million tons of standard fuel or almost 10 percent of production. Of the total of 105 million tons of standard fuel, liquid petroleum may provide about 89 percent.

CHAPTER II

USSR NON-PETROLEUM ENERGY

CHAPTER II

USSR NON-PETROLEUM ENERGY

SECTION 4

COAL IN THE SOVIET UNION

A. Production of Coal

Although considerable publicity has been given to the shift away from the production of coal in the USSR, this source of energy at present is the backbone of the fuels economy of the Soviet Union and will remain as such for a number of years to come.

Despite the importance of coal to the economy of the Soviet Union, the performance of this industry in the first three years of the Seven Year Plan has been wholly unsatisfactory; and it is probable that production in 1965 may represent a gain during the period 1959-65 of only one-half that which had been planned.

As shown in Table 2-1 and graphically in Figure No. 2 the production of coal has failed to meet any of the 1959-61 levels deemed necessary by Soviet planners if the goal of 606-612 million tons by 1965 is to be achieved. Cumulative below-plan production during these three years totals 10 million tons, which would not effect any significant strain on the economy, but it should be pointed out that these shortfalls are in relation to revised annual goals. If actual production were compared with those annual goals which had been established as part of the Seven Year Plan, then cumulative below-plan production would reach almost 74 million tons. It is possible that the failure to meet the annual goals for production of coal has, in fact, forced the Soviet planning organizations to reduce the available exportable surplus of petroleum during these years, in that most probably a portion of the deficit in coal production was covered by making increased quantities of petroleum available to the domestic economy.

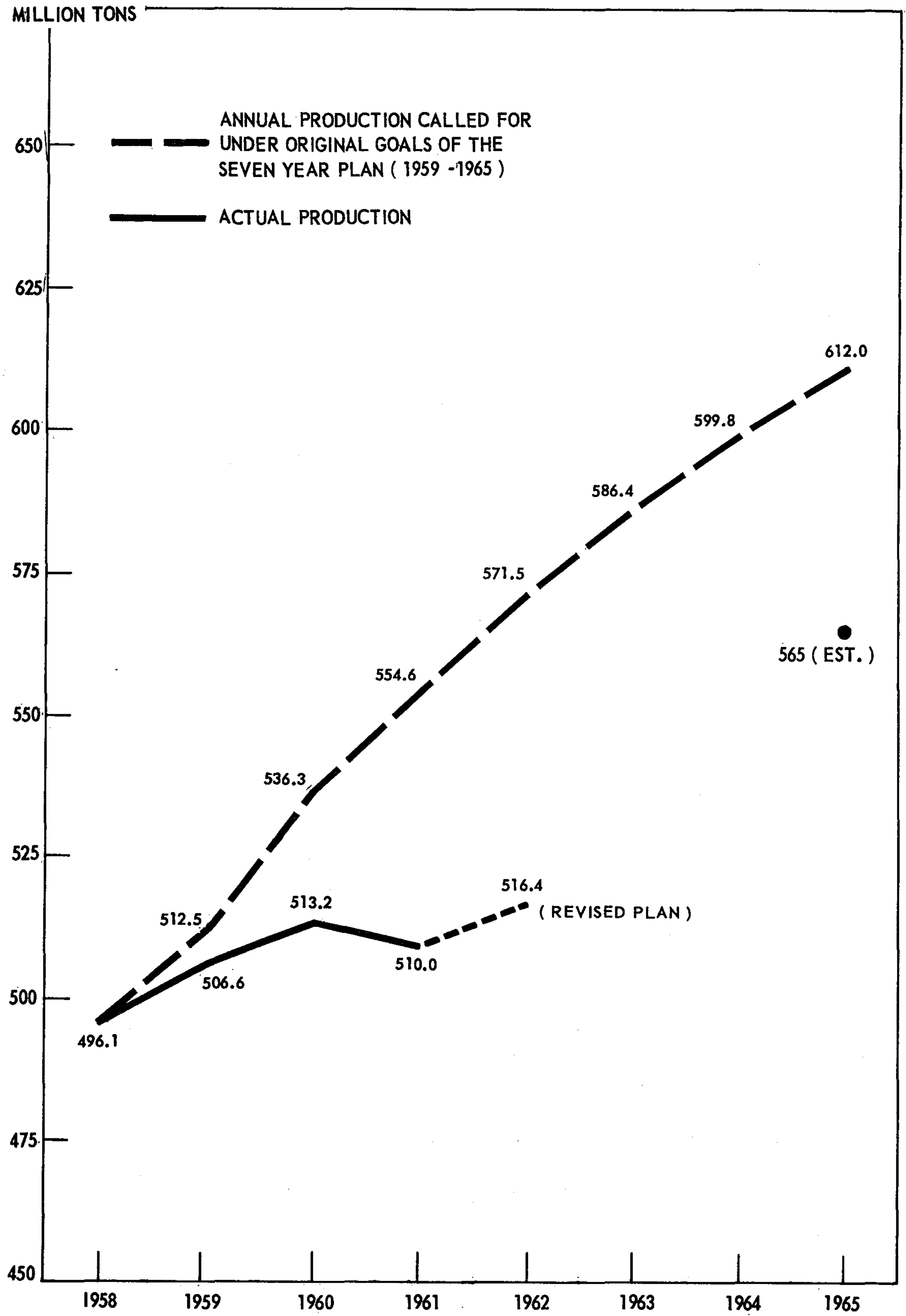
There are a number of reasons why coal production has been lagging recently. Of these, the most important include the slow rate in the construction of new mines in the Donets

Figure No. 2

PRODUCTION OF COAL IN THE USSR

IN THE FIRST THREE YEARS OF THE SEVEN YEAR PLAN

1959 - 1961



Basin, a continued shortage of mining equipment, an inability to achieve the desired results in the hydraulic mining of coal and a shift in emphasis from the production of low-grade coal to production of high-grade coal.

TABLE 2-1

REVISIONS IN THE SEVEN YEAR PLAN GOALS FOR PRODUCTION OF COAL AND ACTUAL OUTPUT DURING 1959-61
(Million Metric Tons)

YEAR	SEVEN YEAR PLAN GOAL a/	REVISED ANNUAL GOAL	ACTUAL	DEFICIENCY
1958	-	-	496.1	-
1959	512.5	500.5 b/	506.6	5.9*
1960	536.3	515.2 c/	513.2	2.1
1961	554.6	511.7 d/	510.0	1.7
1962	571.5	516.4 e/	-	-
1963	586.4	-	-	-
1964	599.8	-	-	-
1965	612.0 f/	-	565.0 b/	47.0 b/

* In relation to the Seven Year Plan goal for 1959. The revision in the goal did not appear until it was certain that the plan would not be met.

a/ 1/

b/ Committee Estimate.

c/ 2/

d/ 3/

e/ Derived from Table 2-2.

f/ High point of range of 606-612 million tons.

Available information indicates that these problems will not be solved for some time to come, that the planning organizations are most aware of this, and that the 1965 goal for production of coal unofficially has been revised downward to 580 million tons. 4/ An official reduction in the 1965 goal may be announced later or the original 1965 goal may be ignored and emphasis placed on meeting the 1970 and 1980 goals. Nevertheless, the Committee believes that actual production of coal in 1965 is unlikely to exceed 565 million tons.

The production of coal in the USSR, by type of coal, for the years 1940-61 and plans for 1962 and 1965 is given in Table 2-2. Following the end of World War Two, there has been a slow but steady decline in the share of brown coal in total output of coal in the USSR, from 33.4 percent in 1945 to 25.1 percent planned for 1962.

The production data given in the above table underline the relative stagnation in production of coal since 1958. To illustrate, the increment in production of coal in 1958 was 32.6 million tons, but the cumulative growth since that time plus that planned for 1962 totals only 20.5 million tons. Thus, in four succeeding years the USSR will have gained in production of coal (if the 1962 plan is met) only two-thirds of that growth achieved in one previous year--1958.

The regional production of coal, as well as by deposit and/or basin, for the years 1955, 1958-60 and that planned for 1965 is given in Table 2-3. Locations of coal basins and deposits are shown on Map No. 1. Production by major area has been as follows (percent of total):

AREA	1955	1958	1959	1960
European USSR	53.1	53.3	53.0	52.2
Urals	12.0	12.3	12.2	12.1
Eastern Regions	34.9	34.4	34.7	35.7
TOTAL	100.0	100.0	100.0	100.0

As noted in Table 2-3, a slightly higher share of the growth in production during 1955-60 has been provided by increases in extraction from deposits in the European USSR, although most of this growth was achieved during 1956-58. Since 1958, most of the growth in production has been achieved in the eastern regions. The absolute growth in 1960--6.6 million tons--was 0.5 million tons less than the growth in production in the eastern regions.

Only small gains have been noted recently in the share of open-pit or strip mining of coal, relative to total national output. Nevertheless, this growth, as illustrated in Table 2-4 is in keeping with the plan for 1965, which calls for 22.3 percent of total coal produced in that year to be provided by strip mining. For comparison, strip mining of coal in 1958 represented 20.3 percent of the total.

TABLE 2-2

PRODUCTION OF COAL IN THE USSR, BY TYPE
1940-1961 AND PLANS FOR 1962 AND 1965
(Million Metric Tons)

		HARD COAL		BROWN COAL	
YEAR	TOTAL a/	AMOUNT a/	AS PERCENT OF TOTAL	AMOUNT a/	AS PERCENT OF TOTAL
1940	165.9	140.0	84.4	25.9	15.6
1941	151.4 b/	NA	NA	NA	NA
1942	75.5 b/	NA	NA	NA	NA
1943	93.1 b/	NA	NA	NA	NA
1944	121.5 b/	NA	NA	NA	NA
1945	149.3	99.4	66.6	49.9	33.4
1946	164.1	114.3	69.7	49.8	30.3
1947	183.2	132.2	72.2	51.0	27.8
1948	208.2	150.0	72.0	58.2	28.0
1949	235.5	169.1	71.8	66.4	28.2
1950	261.1	185.2	70.9	75.9	29.1
1951	281.9	202.5	71.8	79.5	28.2
1952	300.9	215.0	71.5	85.9	28.5
1953	320.4	224.3	70.0	96.1	30.0
1954	347.1	243.7	70.2	103.4	29.8
1955	391.3	276.6	70.7	114.6	29.3
1956	429.2	304.0	70.8	125.2	29.2
1957	463.5	328.5	70.9	135.0	29.1
1958	496.1	353.0	71.2	143.1	28.8
1959	506.6	365.2	72.1	141.4	27.9
1960	513.2	374.9	73.1	138.3	26.9
1961	510.0 c/	380.5	74.6 c/	129.5	25.4
1962 Plan	516.4 d/	386.8	74.9 c/	129.6	25.1
1965 Plan	606-612 e/				
1965 Committee Estimate	565	NA	NA	NA	NA

a/ Except where noted from 5/.
b/ 6/ Virtually all of the loss of production of coal during the war years resulted from the decline in production in the Donets Basin, where output fell off from 85.5 million tons in 1940 to a low of 3.8 million tons in 1942.
c/ 7/
d/ 8/
e/ 9/

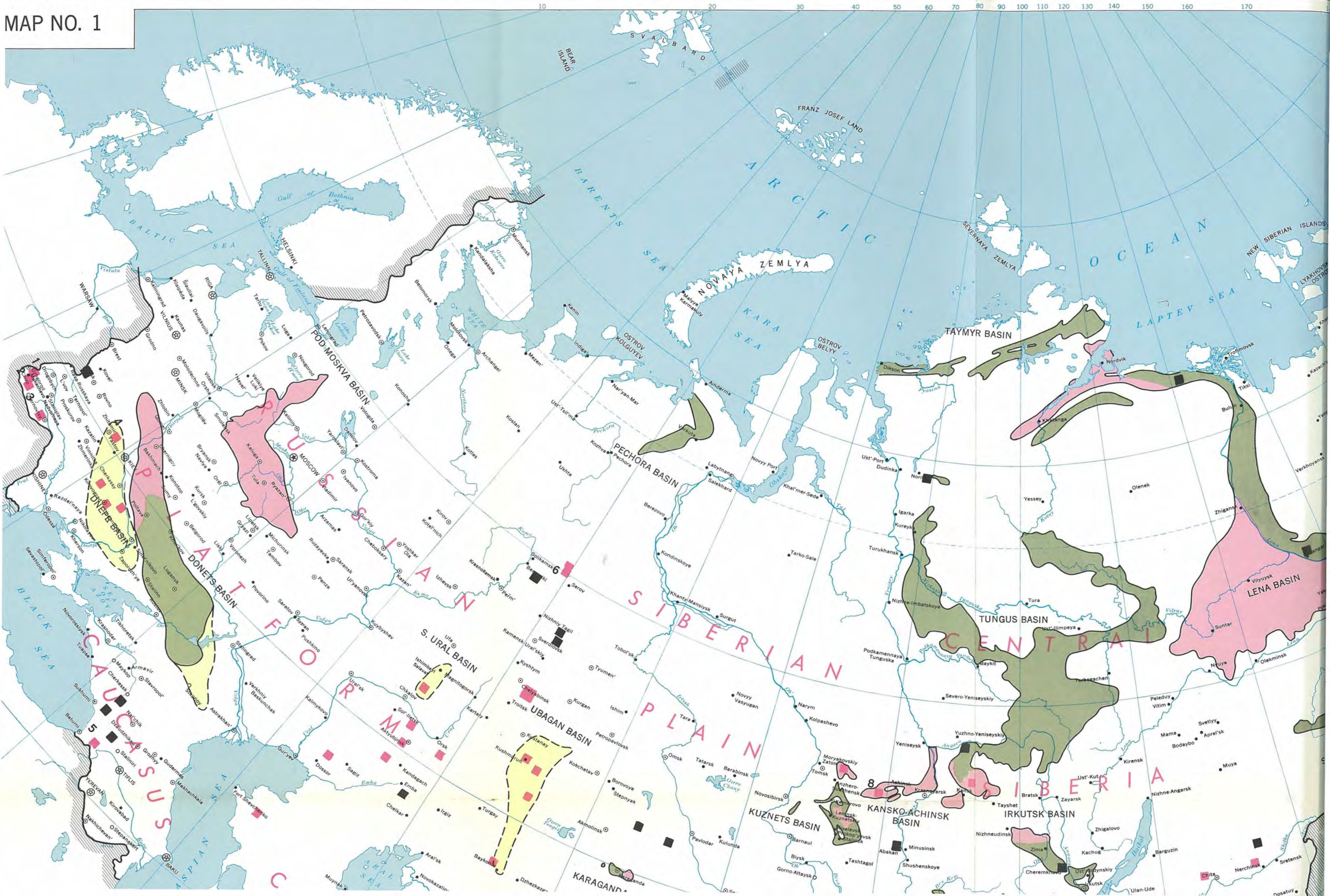
TABLE 2-3

PRODUCTION OF COAL IN THE USSR, BY REGION AND BY BASIN AND DEPOSIT 1955, 1958-1960 AND 1965 PLAN (Million Metric Tons)

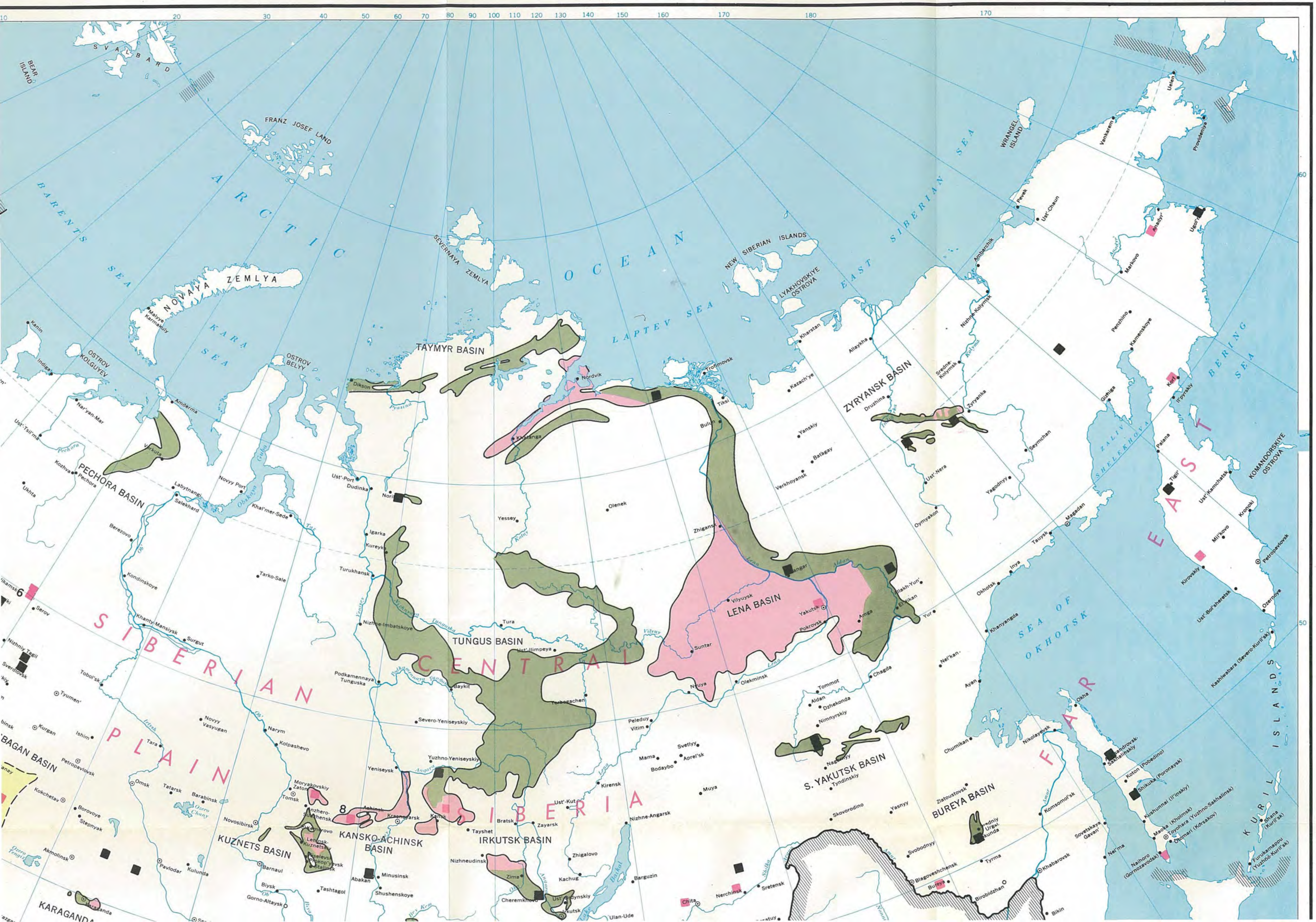
AREA	1955 a/	1958 a/	1959 a/	1960 a/	1965 PLAN b/
EUROPEAN USSR					
Donets Basin	141.0	181.7	185.1	188.2	225.4
Podmoskva Basin	39.5	47.3	47.1	42.8	35.8
Pechora Basin	14.2	16.8	17.5	17.6	19.0
Georgian SSR	2.7	3.0	2.9	2.8	3.8
Other c/	10.4	15.6	16.1	16.6	22.6
TOTAL EUROPEAN	207.8	264.4	268.7	268.0	306.6
PERCENT USSR	53.1	53.3	53.0	52.2	50.1
URALS					
TOTAL URALS	47.1	61.0	61.9	62.1	58.1
PERCENT USSR	12.0	12.3	12.2	12.1	9.5
EASTERN REGIONS					
East Siberia	26.6	36.1	36.5	36.9	54.9
Far East	17.4	20.0	20.7	21.9	25.8
Kazakhstan					
Karaganda	24.7	24.4	24.6	25.8	38.6
Ekibastuzsk	2.3	6.2	6.4	6.0	10.0
Other c/	1.0	0.9	0.7	0.6	2.3
Total Kazakhstan	28.0	31.5	31.7	32.4	50.9
Central Asia					
Uzbek	2.6	3.5	2.9	3.4	NA
Kirgiz	2.7	3.4	3.5	3.5	NA
Tadzhik	0.6	0.8	0.8	0.9	NA
Turkmen	-	-	-	-	NA
Total Central Asia	5.9	7.7	7.2	7.8	11.2
West Siberia (Kuznets)	58.5	75.4	79.9	84.1	104.5
TOTAL EASTERN REGIONS	136.4	170.7	176.0	183.1	247.3
PERCENT USSR	34.9	34.4	34.7	35.7	40.4
TOTAL USSR	391.3	496.1	506.6	513.2	612.0

a/ 10/
b/ 11/
c/ By difference.

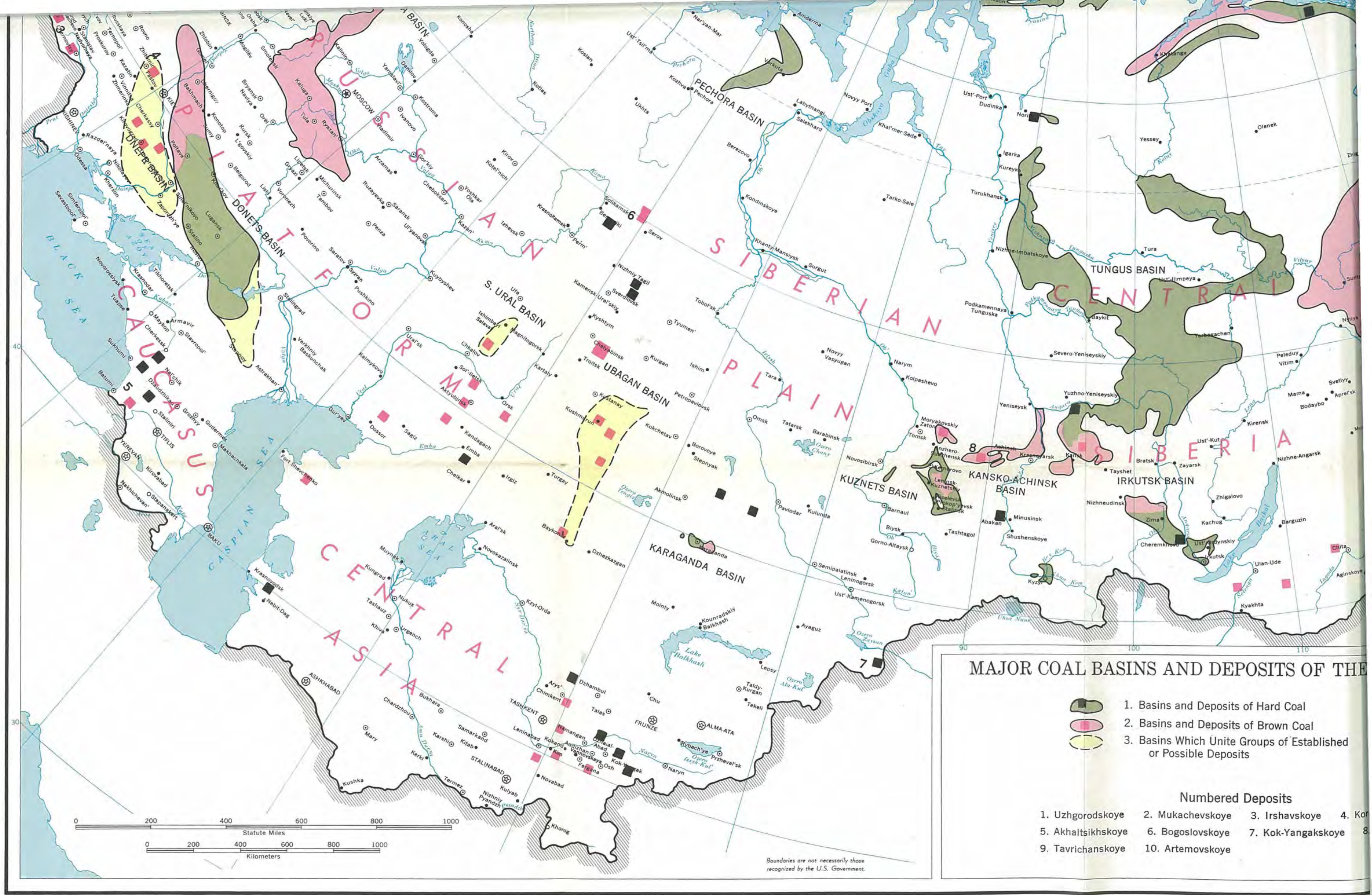
MAP NO. 1



ARCTIC OCEAN
BARENTS SEA
KARA SEA
LAPTEV SEA
BALTIC SEA
BLACK SEA
CASPIAN SEA
WHITE SEA
Gulf of Bothnia
Gulf of Finland
SVALBARD
BEAR ISLAND
FRANZ JOSEF LAND
NOVAYA ZEMLYA
SEVERNAYA ZEMLYA
NEW SIBERIAN ISLANDS
OSTROV KOLGUYEV
OSTROV BELYY
RUSSIAN PLATFORM
WEST SIBERIAN PLAIN
CENTRAL SIBERIA
CAUCASUS
POD-MOSKVA BASIN
DNEPR BASIN
DONETS BASIN
PECHORA BASIN
S. URAL BASIN
UBAGAN BASIN
KUZNETS BASIN
KANSKO-ACHINSK BASIN
IRKUTSK BASIN
TUNGUS BASIN
TAYMYR BASIN
LENA BASIN
KARAGANDA
MOSCOW
LENINGRAD
HELSINKI
TALLINN
RIGA
VILNIUS
MINSK
KIEV
KISHINEV
TIFLIS
YEREVAN
BAKU
WARSAW
Murmansk
Archangel
Vorkuta
Norilsk
Dudinka
Igarka
Khatanga
Nordvik
Tiksi
Yakutsk
Vilyuysk
Olekminsk
Kirensk
Bratsk
Tayshet
Krasnoyarsk
Kansk
Achinsk
Tomsk
Novosibirsk
Barnaul
Omsk
Tyumen'
Sverdlovsk
Nizhniy Tagil
Chelyabinsk
Magnitogorsk
Perm'
Kazan'
Kuybyshev
Saratov
Stalingrad
Astrakhan'
Gur'yev
Aktyubinsk
Orsk
Kustanay
Akmolinsk
Pavlodar
Semipalatinsk
Irkutsk
Ulan-Ude
Chita
Sretensk
Kharkov
Stalino
Rostov
Odessa
Sevastopol'
Krasnodar
Batumi
Sukhumi
Stepnyak
Zhigalovo
Cheremkhovo
Minusinsk
Abakan
Kemerovo
Leninsk-Kuznetskiy
Prokop'yevsk
Stalinsk
Karaganda
Salekhard
Khanty-Mansiysk
Tobol'sk
Surgut
Narym
Kolpashevo
Yeniseysk
Turukhansk
Tura
Olenek
Zhigansk
Verkhoyansk
Bodaybo
Vitim
Ust'-Kut
Nizhne-Angarsk
Nerchinsk



SVALBARD
BEAR ISLAND
FRANZ JOSEF LAND
ARCTIC OCEAN
BARENTS SEA
NOVAYA ZEMLYA
KARA SEA
SEVERNAYA ZEMLYA
LAPTEV SEA
NEW SIBERIAN ISLANDS
LYAKHOVSKIYE OSTROVA
EAST SIBERIAN SEA
WRANGEL ISLAND
BERING SEA
KOMANDORSKIYE OSTROVA
SEA OF OKHOTSK
ZALIV SHELEKHOVA
KURIL ISLANDS
OSTROV KOLGUYEV
OSTROV BELYY
TAYMYR BASIN
PECHORA BASIN
ZYRYANSK BASIN
TUNGUS BASIN
LENA BASIN
S. YAKUTSK BASIN
BUREYA BASIN
KANSKO-ACHINSK BASIN
IRKUTSK BASIN
KUZNETS BASIN
KARAGANDA
WEST SIBERIAN PLAIN
CENTRAL SIBERIA
FAR EAST
Amderma
Vorkuta
Nar'yan-Mar
Ust'-Tsil'ma
Ukhta
Pechora
Salekhard
Labytnangi
Novyy Port
Khal'mer-Sede
Berezovo
Kondinskoye
Khanty-Mansiysk
Surgut
Tarko-Sale
Serov
Nizhniy Tagil
Sverdlovsk
Tobol'sk
Tyumen'
Kurgan
Ishim
Petropavlovsk
Omsk
Tara
Tatarsk
Barabinsk
Novosibirsk
Kokchetav
Akmolinsk
Pavlodar
Kulunda
Barnaul
Biysk
Gorno-Altaysk
Tomsk
Narym
Kolpashevo
Novyy Vasyugan
Dikson
Dudinka
Noril'sk
Igarka
Kureyka
Turukhansk
Nizhne-Imbatskoye
Podkamennaya Tunguska
Baykit
Tura
Ust'-Ilimpeya
Severo-Yeniseyskiy
Yuzhno-Yeniseyskiy
Yeniseysk
Krasnoyarsk
Achinsk
Kansk
Abakan
Minusinsk
Shushenskoye
Tashtagol
Tayshet
Bratsk
Zayarsk
Nizhneudinsk
Zima
Cheremkhovo
Irkutsk
Ulan-Ude
Kirensk
Ust'-Kut
Nizhne-Angarsk
Zhigalovo
Kachug
Barguzin
Chita
Nerchinsk
Sretensk
Khatanga
Nordvik
Yessey
Olenek
Tiksi
Bulun
Zhigansk
Sangar
Vilyuysk
Yakutsk
Pokrovsk
Suntar
Olekminsk
Lensk
Peleduy
Vitim
Mama
Bodaybo
Aldan
Tommot
Chagda
Amga
Yur
Okhotsk
Ayan
Nel'kan
Verkhoyansk
Batagay
Yanskiy
Kazach'ye
Druzhina
Zyryanka
Srednekolymsk
Nizhne-Kolymsk
Ambarchik
Pevek
Ust'-Chaun
Anadyr'
Ugol'nyy
Markovo
Penzhino
Kamenskoye
Gizhiga
Seymchan
Ust'-Nera
Oymyakon
Yagodnyy
Magadan
Tauysk
Palana
Tigil'
Ust'-Kamchatsk
Kronoki
Mil'kovo
Petropavlovsk
Ozernoye
Ust'-Bol'sheretsk
Kirovskiy
Uelen
Vankarem
Provideniya
Skovorodino
Zlatoustovsk
Tyndinskiy
Svobodnyy
Blagoveshchensk
Khabarovsk
Komsomol'sk
Sovetskaya Gavan'
Birobidzhan
Tyrma
Nikolayevsk
Chumikan
Okha
Aleksandrovsk-Sakhalinskiy
Nel'ma


MAJOR COAL BASINS AND DEPOSITS OF THE
1. Basins and Deposits of Hard Coal
2. Basins and Deposits of Brown Coal
3. Basins Which Unite Groups of Established or Possible Deposits
Numbered Deposits
1. Uzhgorodskoye
2. Mukachevskoye
3. Irshavskoye
5. Akhaltsikhskoye
6. Bogoslovskoye
7. Kok-Yangakskoye
9. Tavrichanskoye
10. Artemovskoye
Statute Miles
Kilometers
Boundaries are not necessarily those recognized by the U.S. Government.
PECHORA BASIN
TUNGUS BASIN
DONETS BASIN
DNEPR BASIN
S. URAL BASIN
UBAGAN BASIN
KARAGANDA BASIN
KUZNETS BASIN
KANSKO-ACHINSK BASIN
IRKUTSK BASIN
BLACK SEA
CASPIAN SEA
ARAL SEA
Lake Balkhash

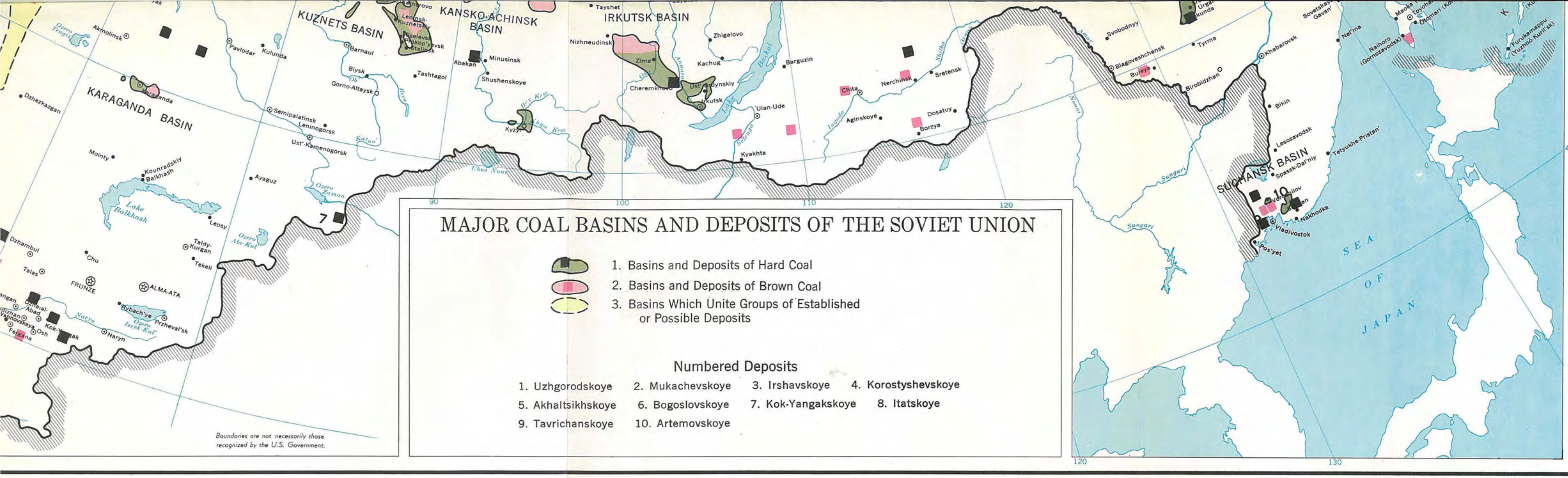

MAJOR COAL BASINS AND DEPOSITS OF THE SOVIET UNION
1. Basins and Deposits of Hard Coal
2. Basins and Deposits of Brown Coal
3. Basins Which Unite Groups of Established or Possible Deposits
Numbered Deposits
1. Uzhgorodskoye
2. Mukachevskoye
3. Irshavskoye
4. Korostyshevskoye
5. Akhaltsikhskoye
6. Bogoslovskoye
7. Kok-Yangakskoye
8. Itatskoye
9. Tavrichanskoye
10. Artemovskoye
KUZNETS BASIN
KANSKO-ACHINSK BASIN
IRKUTSK BASIN
KARAGANDA BASIN
SUCHANSK BASIN
SEA OF JAPAN
Lake Balkhash
Akmolinsk
Pavlodar
Kulunda
Barnaul
Biysk
Gorno-Altaysk
Tashtagol
Abakan
Minusinsk
Shushenskoye
Kyzyl
Tayshet
Nizhneudinsk
Zima
Cheremkhovo
Zhigalovo
Kachug
Barguzin
Ulan-Ude
Kyakhta
Chita
Nerchinsk
Sretensk
Aginskoye
Dosatuy
Borzya
Svobodnyy
Blagoveshchensk
Tyrma
Birobidzhan
Khabarovsk
Bikin
Lesozavodsk
Spassk-Dal'niy
Tetyukhe-Pristan'
Vladivostok
Nakhodka
Pos'yet
Nel'ma
Dzhezkazgan
Semipalatinsk
Leninogorsk
Ust'-Kamenogorsk
Mointy
Kounradskiy
Balkhash
Ayaguz
Lepsy
Taldy-Kurgan
Tekeli
Dzhambul
Chu
Talas
FRUNZE
ALMA-ATA
Rybach'ye
Przheval'sk
Naryn
Osh
Fergana
Ozero Zaysan
Ozero Issyk-Kul'
Boundaries are not necessarily those recognized by the U.S. Government.
90
100
110
120
130
40

TABLE 2-4

DISTRIBUTION BETWEEN UNDERGROUND AND OPEN-PIT MINING OF COAL IN THE USSR SELECTED YEARS 1940-1965

YEAR	UNDERGROUND MILLION METRIC TONS	UNDERGROUND PERCENT OF TOTAL	OPEN-PIT MILLION METRIC TONS	OPEN-PIT PERCENT OF TOTAL
1940	159.6	95.9	6.3	4.1 a/
1950	234.0	89.6	27.1	10.4 a/
1953	278.1	86.8	42.3	13.2 a/
1955	325.6	83.2	65.7	16.8 b/
1956	350.5	81.7	78.7	18.3 a/
1957	373.4	80.6	90.1	19.4 a/
1958	397.5	79.7	98.6	20.3 b/
1959	404.3	79.8	102.3	20.2 b/
1960	408.5	79.6	105.7	20.4 b/
1961	403.9	79.2	106.1	20.8 c/
1962 Plan	404.3	78.3	111.9 c/	21.7
1965 Plan	475.5	77.7	136.5 d/	22.3

a/ 12/
b/ 13/
c/ 14/
d/ 15/

It is unlikely that the USSR will meet the plan for production of coking coal in 1965. This probable shortfall will have serious repercussions on the metallurgical industry and the USSR may find it necessary to step up the imports of coke, concomitantly shutting off exports until this probable deficiency can be overcome. Data on the production of coking coals in the USSR for 1940, 1950-61 and plans for 1962 and 1965 are given in Table 2-5. As shown in this table, the production of coking coal is to increase from 94.4 million tons in 1958 to 156 million tons in 1965. However, a production of only 114.1 million tons has been planned for 1962 which, as indicated above, raises serious doubts as to whether the 1965 goal can be reached.

TABLE 2-5

PRODUCTION OF COKING COALS IN THE USSR
1940, 1945, 1950-61 AND PLANS FOR 1962 AND 1965

YEAR	AMOUNT (MILLION METRIC TONS)	PERCENT OF TOTAL COAL PRODUCTION
1940	35.3 a/	21.3
1945	29.8 b/	20.0
1950	51.7 b/	19.8
1951	54.6 b/	19.4
1952	58.5 b/	19.4
1953	62.2 b/	19.4
1954	70.8 b/	20.4
1955	77.4 b/	19.8
1956	83.0 c/	19.3
1957	87.6 c/	18.9
1958	94.4 a/	19.2
1959	100.8 a/	19.9
1960	110.2 a/	21.5
1961	111.7	21.9 d/
1962 Plan	114.1	22.1 d/
1965 Plan	156.0 e/	25.5

a/ 16/
b/ 17/
c/ 18/
d/ 19/
e/ 20/

B. Reserves of Coal

The total geological reserves of coal in the USSR are estimated by the Soviet authorities to be 8,669.5 billion tons. Elimination of seams of coal too thin for mining and of coals whose ash content is considered too high, reduces the total geological reserves to 7,765.3 billion tons. For purposes of comparison (although the methods of calculation differ to a degree), the geological reserves of coal in the U.S. have been estimated at about 1,500 billion tons. 21/ The distribution of the Soviet geological reserves of coal by area and by deposit is given in Table 2-6.

TABLE 2-6

RESERVES OF COAL IN THE USSR BY AREA AND BY DEPOSIT a/

LOCATION	GEOLOGICAL RESERVES BILLION METRIC TONS	GEOLOGICAL RESERVES PERCENT OF TOTAL	CATEGORY $A+B+C_1$ b/ BILLION METRIC TONS	CATEGORY $A+B+C_1$ b/ PERCENT OF TOTAL
EUROPEAN USSR				
Donets Basin	190.0	2.45	46.44	25.94
Podmoskva	17.5	0.23	6.90	3.85
Pechora	262.4	3.37	5.09	2.84
L'vov-Volynskiy	1.4	0.02	1.26	0.72
Dnepr	3.7	0.05	2.95	1.65
Georgian SSR	0.8	0.01	0.38	0.21
Other	31.7	0.41	0.08	0.04
TOTAL	507.5	6.54	63.10	35.25
URALS				
Kizelov	1.1	0.01	0.65	0.40
Chelyabinsk	1.5	0.02	1.33	0.70
South Urals	1.5	0.02	1.43	0.80
Sverdlovsk Oblast	1.0	0.01	0.48	0.30
Other	1.9	0.03	0.41	0.20
TOTAL	7.0	0.09	4.30	2.40
EASTERN REGIONS				
Kuznets	804.2	10.35	35.70	19.94
Karaganda	46.6	0.60	8.90	4.97
Turgay	35.4	0.46	7.60	4.25
Maykyuben'sk	13.4	0.17	1.50	0.84
Ekibastuz	10.7	0.14	8.40	4.69
Other Deposits of Kazakhstan	16.4	0.21	2.10	1.17
Kavsko-Achinsk	1,207.8	15.52	20.00	11.17
Tungussk	1,516.0	19.52	1.70	0.95
Taymyr	511.6	6.59	0.10	Negl.
Lenskiy	2,418.0	31.14	2.30	1.28
Sakhalin Island	19.4	0.25	2.00	1.19
Central Asia	38.3	0.49	4.10	2.29
Other	613.0	7.93	17.20	9.61
TOTAL	7,250.8	93.37	111.60	62.35
TOTAL USSR	7,765.3	100.00	179.00	100.00

a/ 22/

b/ Category A plus B is considered to represent the industrial or commercially exploitable reserves. Category C_1 designated as probable reserves, has been delineated quantitatively and qualitatively by reconnaissance drilling.

As shown in Table 2-6 the geological reserves of coal (that amount which is considered as belonging to Categories A plus B plus C_1, or commercially exploitable plus probable) represents only 2.3 percent or 179 billion tons. The major portion of these latter reserves is to be found in the Donets Basin--about 26 percent of the total--and in the Kuznets Basin--about 20 percent of the total. More than 62 percent of the A and B and C_1 reserves is to be found in the eastern regions of the country, and only about 35 percent in the European regions of the USSR. Only minor amounts of coal are available for exploitation in the Urals industrial region. Consequently, this area, as described elsewhere, is in the future to rely heavily upon natural gas as the primary source of fuel.

The larger portion of the geological reserves of coal is to be found between the depths of 601 meters and 1,200 meters. Distribution of the geological reserves, according to depth, is as follows:

DEPTH (METERS)	PERCENT OF TOTAL
Up to 300	26.8
301 to 600	20.6
601 to 1,200	32.8
1,201 to 1,800	19.8
TOTAL	100.0

C. Costs of Production

It is most interesting to note that the planned cost of production of all coals in the USSR in 1965 is to be 6.97 rubles/ton or about 5 percent higher than the 1955 level but about 15 percent below 1961 costs. The cost of production declined in the period 1950-1957 from 7.68 to 6.76 rubles/ton, but increased in 1958 to 7.92 rubles/ton primarily because of the reduced work week. 23/ Thus, the main effort during the Seven Year Plan is to be concerned with bringing the costs of production of coal back in line with the cost level which prevailed prior to introduction of the reduced work week. Some information is available on what Soviet planners hope costs of production will be in 1980. Analysis of this information indicates that during the 20-year period 1961-80, costs of production of coal are to be reduced by approximately 55 to 57 percent, to be brought about largely by emphasis of production through stripping in the eastern regions of the country. Table 2-7 presents the cost of production for the years shown.

TABLE 2-7

COST OF PRODUCTION OF COAL IN THE USSR
1950-55, 1957-61 AND 1965 AND 1980 PLANS

YEAR	RUBLES PER METRIC TON
1950	7.68 a/
1951	7.41 b/
1952	7.10 b/
1953	6.95 b/
1954	6.84 b/
1955	6.58 b/
1956	NA
1957	6.76 c/
1958	7.92 d/
1959	8.46 e/
1960	8.27 e/
1961	8.17 f/
1965 Plan	6.97 c/
1980 Plan	4.55-4.71 g/

a/ 24/
b/ 25/
c/ 26/
d/ The cost of production in 1958 was 20 percent higher than the cost in 1955.
e/ 27/
f/ 28/
g/ 29/

Table 2-8 illustrates the considerable fluctuation in the cost of production of the various types of coal in the USSR (1959 data).

TABLE 2-8

COMPARATIVE COSTS OF PRODUCTION OF SELECTED TYPES OF COAL IN THE USSR a/ - 1959

TYPE OF COAL	RUBLES PER METRIC TON
Donets	11.1 b/
PodMoskva	7.0
Kuznets	6.8
Pechora	12.7
Karaganda	6.0
Krasnoyarsk	2.4
Irsha-Borodinsk	1.0
Nazarova	1.3

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a/ 30/
b/ 31/

Of the types of coals illustrated in Table 2-8 the Donets coal has the most influence on the national average, as 36.7 percent of total annual production is derived from the Donets Basin. Donets coal is among the most expensive of all coals, being second only to Pechora coals, whose geographic location in the far north greatly influences the cost of production. On the other hand, costs of production of the various types of coal, in relation to the calorific value, indicate that in this respect PodMoskva coals (Moscow Basin) are the most expensive of the major areas of production. The cost (per ton of standard fuel) of the Moscow Basin coals, as shown in the following tabulation, is almost double the cost of the Donets coals: 32/

TYPE OF COAL	RUBLES PER METRIC TON OF STANDARD FUEL
Donets	12.5
Kuznets	6.9
PodMoskva (Moscow Basin)	23.8
Karaganda	6.5
Pechora	15.3

D. Consumption of Coal

As shown in Table 2-9, thermal electric power stations are the largest single consumer of coal in the USSR. The share of thermal power stations in the total consumption of coal--about 33 percent in 1958--is to increase to 41.1 percent in 1965. However, the most dramatic shift in the distribution of coal among the various consumers is to be brought about by the transfer of rail transport from steam drive to diesel and electric. As a result of this change-over, requirements for coal by rail transport are to decline drastically, and the share of railroads in the total consumption of coal is to be reduced from 17.3 percent in 1958 to 1.2 percent in 1965.

TABLE 2-9

CONSUMPTION OF COAL IN THE USSR, BY CONSUMER a/ - 1958 AND 1965 PLAN

	1958		1965 PLAN	
CONSUMER	MILLION METRIC TONS	PERCENT OF TOTAL	MILLION METRIC TONS	PERCENT OF TOTAL
Communal-Households	60.1	13.1	102.2	18.3
Coking	71.0	15.5	118.3	21.1
Electric Power and Heat from Thermal Power Stations	150.0	32.8	230.0	41.1
Other Industry and Agriculture	97.7	21.3	102.5	18.3
Railroads*	79.3	17.3	6.9	1.2
TOTAL	458.1 b/	100.0	559.9 b/ c/	100.0

* Steam engines only.

a/ 33/

b/ Excluding losses in cleaning, etc.

c/ Related by Soviet authorities to the plan goal for production in that year.

More coal is to be made available for consumption by the communal-household sector, whose share of total consumption is to increase from 13.1 percent to 18.3 percent. Growth in the demand for coal in coking is to increase the share of this sector from 15.5 percent of the total consumption in 1958 to 21.1 percent in 1965.

Distribution of the consumption of coal by Economic Region underlines the high relative requirements for coal by the metallurgical industries of the South and in the Urals, plus the comparatively large consumption of coal in the Center, or the Moscow industrial region. Together, these three regions (South, Urals and Center) accounted for 62.5 percent of total consumption of coal in the USSR in 1958 but are to fall off to about 55 percent of the total in 1965, primarily as a result of displacement of coal by natural gas and, to a lesser degree, through increased requirements for coal in Siberia. The regional distribution of consumption of coal in the USSR in 1940, 1958 and that planned for 1965 is given in Table 2-10.

A comparison of the regional production and consumption of coal for 1958 and that planned for 1965 defines the Urals industrial region as a coal deficit area both in 1958 and in 1965. 36/ Although as explained elsewhere in this report, large amounts of natural gas are to be made available to the Urals industries by 1965, Soviet planners have foreseen no significant decline in the absolute production of coal in the Urals, but concomitantly have indicated a minor decline in the consumption of coal. Thus the coal deficit in the Urals of 32.3 million tons in 1958 will be reduced to a deficit of 28.3 million tons by 1965.

West Siberia and Kazakhstan and the Central Asian Republics are to maintain their positions as surplus producers of coal, while the general European area of the USSR is to be converted from a coal-deficit area to a coal surplus area as the result of an increase in production in excess of the planned increase in consumption. The growth in consumption is to be depressed as a result of increased availability of liquid and gaseous fuels.

TABLE 2-10

CONSUMPTION OF COAL IN THE USSR, BY ECONOMIC REGION - 1940, 1958 AND 1965 PLAN
(Percent of Total)

ECONOMIC REGION	NUMERICAL DESIGNATION	1940 a/	1958 a/	1965 PLAN b/
North	Ib	0.5	2.2	2.0
Northwest	Ia	4.8	3.4	3.4
Center	VII	18.5	16.9	13.6
PoVolga	VI	2.8	2.5	1.5
North Caucasus	IV	2.9	3.0	2.4
Urals	VIII	13.0	19.6	14.8
West Siberia	IX	7.3	7.5	11.8
East Siberia	XI	5.0	5.7	9.1
Central Asia and Kazakhstan	X	4.2	6.1	8.8
Transcaucasus	V	0.4	1.2	0.7
South	III	34.5	26.0	26.7
West	II	1.5	2.0	0.6
Far East	XII	4.6	3.9	4.6
TOTAL		100.0	100.0	100.0

a/ 34/
b/ 35/

E. Trade

As shown in Table 2-11, the Soviet Union became a net exporter of coal and coke in 1956 and gradually has strengthened her position as a net exporter since that time. Most of

TABLE 2-11

REPORTED USSR NET TRADE IN COAL AND COKE
1955 - 1960 a/
(Thousand Metric Tons)

YEAR	EXPORTS			IMPORTS			NET c/		
	COAL	COKE b/	TOTAL	COAL	COKE b/	TOTAL	COAL	COKE b/	TOTAL
1955	4,312.7	2,263	6,575.7	8,663.5	631	9,294.5	+4,350.8	-1,632	+2,718.8
1956	5,672.7	2,750	8,422.7	6,390.3	841	7,231.3	+ 717.6	-1,909	-1,191.4
1957	8,772.3	3,074	11,846.3	3,423.2	519	3,942.2	-5,349.1	-2,555	-7,904.1
1958	9,951.0	3,384	13,335.0	3,826.0	949	4,775.0	-6,125.0	-2,435	-8,560.0
1959	11,069.0	3,424	14,493.0	4,384.0	882	5,266.0	-6,685.0	-2,542	-9,227.0
1960	12,315.0	3,704	16,019.0	4,800.0	921	5,721.0	-7,515.0	-2,783	-10,298.0

a/ 37/
b/ For this table, coke has been converted to coal equivalents at the rate of 1.4 tons of coal for each ton of coke.
c/ A plus (+) sign designates net import; a minus (-) sign designates net export.

the shift in exports has been with respect to coal. In 1955, the USSR was a net importer of coal to the extent of almost 4.4 million tons, but within 2 years, changed this position to one of a net exporter of coal to the extent of almost 5.35 million tons. Only a gradual change has been indicated in the import and export of coke, as the USSR has increased its net export of this product from 1.6 million tons in 1955 to about 2.8 million tons in 1960.

1. Exports

The exports of coal and coke from the USSR, as reported in the Soviet trade statistical handbooks, have been inflated to the extent that such statistics include Polish coal and coke which, although shown as having been imported by the USSR, were re-exported on Soviet account to East Germany*. In order to derive the actual exports of coal and coke from the USSR in a given year, the reported exports must be reduced by an amount equivalent to the quantities of Soviet coal and coke shown in the trade handbooks as being imported by East Germany (see Table 2-14). The adjusted exports of coal and coke from the USSR for the years 1955-60 are given in Table 2-12.

From Table 2-12, it can be seen that of the total actual exports during 1955-60, those to the West have fluctuated from a peak of 61.5 percent of the total in 1956 to 44.3 percent of the total in 1957, but beyond 1957, the share of exports to the West apparently has been stabilized into a growing share of the total, reaching to 56.5 percent in 1960. The sharp relative decline in exports to the West in 1957 may be explained by increased deliveries to Hungary and to Czechoslovakia. As illustrated by Table 2-13, which presents the adjusted exports of coal and coke from the USSR to other Bloc countries for 1955-60, the 1957 growth in deliveries to Czechoslovakia has been preserved in the succeeding years, whereas the increased deliveries to Hungary in 1957 apparently were on a one-time only basis.

The major importer in the West of Soviet coal and coke is Yugoslavia. In 1960 such Yugoslavian imports represented 18.7 percent of total Soviet sales to the West (see Table 2-15).

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* Except in 1957, where certain quantities of Polish coal were re-exported to Hungary and Czechoslovakia.

TABLE 2-12

ADJUSTED EXPORTS OF COAL AND COKE FROM THE USSR a/
1955 - 1960
(Thousand Metric Tons)

DESTINATION	1955	1956	1957	1958	1959	1960
TO WEST						
Coal	1,793.1	2,576.1	3,029.7	3,606	4,201	5,011
Coke b/	153.4	184.8	256.2	393	395	516
Total b/	1,946.5	2,760.9	3,285.9	3,999	4,596	5,527
Percent Grand Total	57.9	61.4	44.3	49.2	52.3	56.5
TO BLOC						
Coal	385.7	555.8	2,560.4	2,787.0	2,745.5	2,788.0
Coke	1,029.7	1,178.8	1,568.8	1,346.0	1,441.0	1,472.0
Total	1,415.4	1,734.6	4,129.2	4,133.0	4,186.5	4,260.0
Percent Grand Total	42.1	38.6	55.7	50.8	47.7	43.5
TOTAL COAL	2,178.8	3,131.9	5,590.1	6,393.0	6,946.5	7,799.0
TOTAL COKE	1,183.1	1,363.6	1,825.0	1,739.0	1,836.0	1,988.0
GRAND TOTAL COAL & COKE	3,361.9	4,495.5	7,415.1	8,132.0	8,782.5	9,787.0

a/ 38/
b/ Includes small quantities not allocated according to destination.

TABLE 2-13

ADJUSTED EXPORTS OF COAL AND COKE FROM THE USSR TO OTHER BLOC COUNTRIES a/
1955 - 1960
(Thousand Metric Tons)

	1955	1956	1957	1958	1959	1960
ALBANIA						
Coke	-	1.8	3.5	2.0	-	-
BULGARIA						
Coke	18.5	21.6	62.1	89.0	141.0	103.0
HUNGARY						
Coal	0.6	147.2	1,097.5 b/	90.0	67.0	204.0
Coke	384.0	421.3	488.8	617.0	564.0	594.0
Woody Coal	5.6	3.6	3.5	1.0	1.5	3.0
TOTAL	390.2	572.1	1,589.8	708.0	632.5	801.0
EAST GERMANY c/						
Coal	149.5	148.9	618.1	1,219.0	926.0	547.0
Coke	192.3	320.3	557.3	236.0	316.0	368.0
TOTAL	341.8	469.2	1,175.4	1,455.0	1,242.0	915.0
NORTH KOREA						
Coal	-	-	72.6	-	-	-
Coke	-	-	30.1	-	-	-
TOTAL	-	-	102.7	-	-	-
MONGOLIA						
Coal	195.6	163.7	78.0	77.0	74.0	53.0
Coke	0.1	0.1	0.2	-	1.0	-
TOTAL	195.7	163.8	78.2	77.0	75.0	53.0
POLAND						
Coal	19.1	12.2	14.0	390.0	615.0	794.0
RUMANIA						
Coal	-	-	-	-	26.0	133.0
Coke	434.8	413.7	426.8	402.0	419.0	407.0
TOTAL	434.8	413.7	426.8	402.0	445.0	540.0
CZECHOSLOVAKIA						
Coal	15.3	80.2	676.7 d/	1,010.0	1,036.0	1,054.0
GRAND TOTAL	1,415.4	1,734.6	4,129.2	4,133.0	4,186.5	4,260.0

a/ 39/
b/ Excluding 120 thousand tons of Polish coal re-exported from the USSR.
c/ See Table 2-14 derivation.
d/ Excluding 180 thousand tons of Polish coal re-exported from the USSR.

TABLE 2-14

EAST GERMANY IMPORTS OF COAL AND COKE FROM THE USSR
(FROM POLAND ON SOVIET ACCOUNT AND ACTUAL IMPORTS FROM THE USSR) a/
1955 - 1960
(Thousand Metric Tons)

	1955	1956	1957	1958	1959	1960
Coal						
From Poland on Soviet Account	2,139.5	2,544.4	2,885.9	3,559.0	4,124.0	4,519.0
From USSR	149.5	148.9	618.1	1,219.0	926.0	547.0
Total Coal	2,289.0	2,693.3	3,504.0	4,778.0	5,050.0	5,066.0
Coke						
From Poland on Soviet Account	434.6	600.9	371.0	678.0	630.0	658.0
From USSR	192.3	320.3	557.3	236.0	316.0	368.0
Total Coal	626.9	921.2	928.3	914.0	946.0	1,026.0
TOTAL COAL & COKE FROM POLAND ON SOVIET ACCOUNT	2,574.1	3,145.3	3,256.9	4,237.0	4,754.0	5,177.0
TOTAL COAL & COKE FROM USSR	341.8	469.2	1,175.4	1,455.0	1,242.0	915.0
GRAND TOTAL	2,915.9	3,614.5	4,432.3	5,692.0	5,996.0	6,092.0

a/ 40/

TABLE 2-15

REPORTED FREE WORLD IMPORTS OF SOVIET COAL AND COKE BY COUNTRY a/
1960
(Thousand Metric Tons)

COUNTRY	COAL	COKE	TOTAL	PERCENT OF TOTAL
Austria	733	64	797	14.5
Belgium	20		20	0.4
Holland	32		32	0.6
Greece	51	9	60	1.2
Denmark	413	76	489	8.9
Italy	475		475	8.6
West Germany	66		66	1.2
Finland	739	99	838	15.2
France	795		795	14.4
Sweden	141	125	266	4.8
Yugoslavia	927	101	1,028	18.7
Japan	542		542	9.9
Iceland	1	1	2	Insig.
Switzerland	6		6	0.1
Ethiopia	8		8	0.1
Egypt	24	28	52	1.0
Tunisia	21		21	0.4
TOTAL	4,994	503	5,497	100.0

a/ 41/

Finland is the second largest importer--15.2 percent in 1960, followed closely by Austria with 14.5 percent and France with 14.4 percent of the total. Thus, these four countries together accounted for about two-thirds of the Free World imports of Soviet coal and coke in 1960.

2. Imports

Although the Soviet trade statistical handbooks show considerable quantities of coal and coke as being imported by the USSR annually, most of these imports are from Poland, and as explained above, all of the reported Polish exports of coal and coke to the USSR are re-exported on Soviet account to East Germany* (see Table 2-14). Thus, after deducting the reported imports of Polish coal and coke in quantities equal to reported East German imports of Soviet coal and coke, actual Soviet imports of coal for the years 1955-60 may be arrived at as shown in Table 2-16. The Soviet Union does not report the importation of coke from any other country and, after making allowances for the re-export of the Polish coke, shows a balance of no imports of coke.

Table 2-16 further illustrates that in 1955 and 1956 relatively large quantities of Polish coal actually were imported by the Soviet Union, but no further imports have been indicated since that time.

Of the actual quantities of coal which are imported by the Soviet Union, the bulk is provided by Communist China, which has delivered to the USSR on the average since 1956 about 200 thousand tons each year. Imports from Hungary have averaged about 50 thousand tons each year since 1958.

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* With the exception of 1957, when certain quantities of the Polish coal were re-exported to Hungary and Czechoslovakia.

TABLE 2-16

ADJUSTED IMPORTS OF COAL
BY THE USSR a/ - 1955-60
(Thousand Metric Tons)

COUNTRY	1955	1956	1957	1958	1959	1960
Hungary	24.5	30.0	20.0	49.0	47.0	57.0
Poland	5,906.5 b/	3,595.6 b/	.0	.0	.0	.0
China	520.0	209.0	201.9	208.0	204.0	200.0
TOTAL	6,451.0	3,834.6	221.9	257.0	251.0	257.0

a/ 42/ Adjusted by deducting those amounts of coal and coke shown in the statistical handbooks as imported by the USSR but which in practice, were re-exported on Soviet account to East Germany (except in 1957, when certain quantities were re-exported to Hungary and Czechoslovakia).

b/ Actual imports of Polish coal and coke in these years.

F. Pricing

A broad sampling of prices charged by the Soviet Union for its coal indicates, as in the case of oil, that the European Satellite countries in 1960 paid by far the highest prices for coal. On the other hand, those countries which make up the Communist Far East (Communist China and Mongolia) have during the period paid the lowest prices per ton, as shown in Table 2-17.

Prices paid by the underdeveloped areas of the Free World generally have been comparable to those charged to the Communist Far East.

It is probable that the price differential reflected in Table 2-17 may be explained by (1) quality of the coal shipped and (2) implementation of the general Soviet pricing program which embraces both political and economic motives.

TABLE 2-17

COMPARISON OF PRICES PAID FOR SOVIET COALS, BY SELECTED IMPORTING AREAS 1955, 1957 AND 1960 (Rubles Per Metric Ton)

IMPORTING AREA	1955	1957	1960
Industrial West	16.50	21.95	12.91
European Satellites	18.63	21.76	16.39
Communist Far East	12.07	16.15	9.92
Free World Under-developed Areas	13.54	17.88	10.36

Very little difference exists in the prices paid by the Soviet Union for coal from the European Satellites and for coal from Communist China:

ORIGIN	RUBLES PER METRIC TON 1955	1957	1960
European Satellites*	13.86	10.00	12.67
Communist China	9.59	9.59	12.94

* Hungary.

G. Prospects For The Future

Plans for the development of the coal industry during the 20-year period 1961-80 call for what the Committee considers to be completely unreasonable production goals. As indicated by published data, the production of coal is to reach the following levels:

YEAR	MILLION METRIC TONS
1970	686-700 43/
1975	900 44/
1980	1,180-1,200 43/

In view of the comparatively high costs of production of coal, the problems currently retarding expansion of production, and of the probability of achieving the planned levels of extraction of crude oil and natural gas, it is more likely that the responsible planning authorities will at some future date take the necessary steps to reduce these goals to levels more in keeping with desirability and capability.

Nevertheless, it may be useful to discuss some of the general aspects of the 20-year plan for expansion of the coal industry.

The growth in production of coal is to be based on the development of the cheap and readily-exploitable deposits of coal in the eastern regions of the country. The share of the eastern regions in the total national production of coal is to increase from about 41 percent in 1965 to 47.9 percent in 1970 and further to 66 percent in 1980, as shown in the following tabulation:

	PERCENT OF TOTAL			
AREA	1960 a/	1965 a/	1970 b/	1980 b/
European USSR	52.2	50.1	44.8	32.5
Eastern Regions	35.7	40.4	47.9	66.0
Urals	12.1	9.5	7.3	1.5
TOTAL	100.0	100.0	100.0	100.0

a/ From Table 2-3.
b/ 45/

The shift to the eastern regions will permit an increase in the amounts of coal produced by stripping. As shown in Table 2-18, in 1980, 51.5 percent of the coal is to be produced from strip mines, of which 96 percent will be provided by strip mining in the eastern regions.

The increased production of coal from strip mines will contribute to growth in labor productivity in coal mining and to a reduction in the cost of extraction. Output per worker is to increase from 43 tons per month in 1960 to 140 tons per month in 1980 which, if achieved, will call for a production labor force of only 714 thousand as compared to a force of 2.32

million if there were no change in labor productivity. In addition, the cost of production of a ton of coal in 1980 is to decline to 43 to 45 percent of the 1960 level, for a savings in production costs of about 40 billion rubles in 1980 alone.

TABLE 2-18

METHODS OF PRODUCTION OF COAL IN THE USSR a/ - 1960, 1965, 1970 AND 1980 (Percent of Total)

YEAR	UNDERGROUND SHAFT	STRIPPING	HYDRAULIC	TOTAL
1960	79.3	20.4	0.3	100.0
1965	72.7	23.8	3.5	100.0
1970	60.1	30.4	9.5	100.0
1980	38.9	51.5	9.6	100.0

a/ 46/

SECTION 5

HYDROELECTRIC AND ELECTRIC POWER

A. Potential

In terms of hydroelectric power technical potential--1,721 billion kilowatt-hours per year (see Table 2-19)--the USSR ranks second in the world, after Communist China, which has an estimated technical potential of 2,000 billion kilowatt-hours per year.

Distribution of the technical potential--1,721 billion kilowatt-hours per year--among the Economic Regions of the USSR illustrates the very high degree of concentration of this potential in the eastern regions of the country, particularly in East Siberia and the Far East, and to a lesser degree, in Central Asia. Together these three areas account for almost three-quarters of the technical potential, as shown in the following:

ECONOMIC REGION	BILLION KILOWATT-HOURS/YEAR	PERCENT OF TOTAL
Northwest	21	1.2
North	25	1.5
Center	15	0.9
PoVolga	43	2.5
Urals	19	1.1
North Caucasus	40	2.3
West Siberia	130	7.6
East Siberia	800	46.5
Far East	250	14.5
West	10	0.6
South	19	1.1
Transcaucasus	64	3.7
Kazakhstan	60	3.4
Central Asia	225	13.1
TOTAL	1,721	100.0

TABLE 2-19

HYDROELECTRIC RESOURCES OF THE USSR a/

BASIS	MILLION KILOWATTS	BILLION KILOWATT-HOURS/YEAR
Theoretical potential (including minor rivers) b/	420.0	3,680
Theoretical potential (based on the 1,477 largest rivers) b/	340.0	2,978
Technical potential c/	196.5	1,721
Economic potential d/	137.0	1,200

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a/ 1/

b/ Theoretical potential
Gross head of the river. The mean river flow, with 100 percent efficiency of conversion and no losses.

c/ Technical potential
From an engineering standpoint, but disregarding economics. Losses are considered.

d/ Economic potential
Amount of hydroelectric resources considered to be economically exploitable.

B. Production

For the past several years the output of electric power by hydroelectric plants has represented about 17 to 18 percent of the total electric power generated in the USSR. The generation of electric power by hydroelectric power stations is compared with total electric power output in the USSR for the years 1950-61 and with that planned for 1962 and 1965 in Table 2-20.

TABLE 2-20

GENERATION OF ELECTRIC POWER IN THE USSR a/
1950-1961 AND PLANS FOR 1962 AND 1965

YEAR	TOTAL (MILLION KILOWATT-HOURS)	OF WHICH, FROM HYDROPOWER STATIONS: AMOUNT (MILLION KILOWATT-HOURS)	PERCENT OF NATIONAL TOTAL
1950	91,226	12,691	13.9
1951	104,022	13,722	13.2
1952	119,116	14,908	12.5
1953	134,325	19,201	14.3
1954	150,695	18,561	12.3
1955	170,225	23,165	13.6
1956	191,653	28,984	15.1
1957	209,688	39,429	18.8
1958	235,350	46,478	19.7
1959	265,112	47,630	18.0
1960	292,274	50,913	17.4
1961	327,000 e/ b/	57,000 b/ c/	17.4
1962 Plan	366,000 f/ d/	66,000 b/ c/	18.0
1965 Plan	520,000 d/ e/	90,000 c/ f/	17.3

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a/ Except where noted, from 2/.
b/ 3/
c/ Estimated on the basis of planned addition to capacity.
d/ 4/
e/ 5/
f/ 6/

TABLE 2-21

CAPACITY FOR GENERATION OF ELECTRIC POWER IN THE USSR a/
1950-61 AND PLANS FOR 1962 AND 1965

YEAR	TOTAL (THOUSAND KILOWATTS)	OF WHICH, FROM HYDROPOWER STATIONS (THOUSAND KILOWATTS)	(PERCENT OF TOTAL)
1950	19,614	3,218	16.4
1951	22,117	3,338	15.1
1952	25,250	3,814	15.1
1953	28,602	4,520	15.8
1954	32,815	5,135	15.6
1955	37,246	5,996	16.1
1956	43,470	8,498	19.5
1957	48,397	10,040	20.7
1958	53,641	10,863	20.3
1959	59,267	12,710	21.4
1960	66,721	14,781	22.2
1961	73,800 b/	16,600 c/	22.5
1962 Plan	82,700 d/	19,000 c/	23.0
1965 Plan	114,000 e/	25,000 f/	21.9

a/ Except where noted from 7/
b/ 8/
c/ Estimate.
d/ 9/
e/ 10/
f/ 11/

The installed capacity for generation of electric power at hydropower stations represents a slightly higher portion of total electric power generating capacity in the country than does actual output. In addition, this share of the national total has been steadily increasing, from 16.1 percent in 1955 to 23 percent in 1961, whereas for the past several years, the generation of electric power by hydropower stations has shown a decline, if only slight, as a percent of the national total. Total capacity for generation of electric power in the USSR and that available at hydropower stations for 1950-61 and plans for 1962-65 is illustrated in Table 2-21.

The regional distribution of production of hydroelectric power, when compared with the regional distribution of the technical potential, clearly illustrates the varying degree of development of this potential within the USSR--as might be expected. For example, the Northwest contains only 1.2 percent of the estimated hydropower technical potential, yet in 1955 the production of hydroelectric power in this region represented more than 25 percent of total hydropower output. Apportionment of hydroelectric power output by economic region of the RSFSR in 1955 is given in Table 2-22.

TABLE 2-22

PRODUCTION OF HYDROELECTRIC POWER BY ECONOMIC REGION OF THE RSFSR a/
1955
(Million Kilowatt-Hours)

ECONOMIC REGION	AMOUNT
North	10.2
Northwest	6,200.0
Center	2,000.0
PoVolga	20.1
North Caucasus	0.0
Urals	800.0
West Siberia	18.5
East Siberia	37.0
Far East	3.1
TOTAL	9,088.9

a/ 12/

Table 2-23 presents the distribution of electric power output and generating capacity for 1958-60 between the European portion of the USSR (Economic Regions I to VIII) and the eastern regions of the country. There has been no shift regionally with respect to generating capacity, and only a slight relative gain in the output of electric power in the eastern regions. However, in terms of developing the output of electric power in the eastern regions from hydroelectric power stations, the Seven Year Plan is to bring about a marked change. In this change, as shown in the following tabulation, although the output of electric power in the eastern regions is to increase from 38 percent of the total in 1958 to 46 percent in 1965, that generated from hydropower stations in the eastern regions is to increase from 24.4 percent of the total hydropower output in 1958 to 40.5 percent in 1965.

	(PERCENT OF TOTAL)			
	1958		1965 PLAN	
AREA	TOTAL ELECTRIC POWER OUTPUT a/	HYDRO-POWER OUTPUT b/	TOTAL ELECTRIC POWER OUTPUT a/	HYDRO-POWER OUTPUT b/
European USSR (including Urals)*	62	75.6	54.0	59.5
Eastern Regions	38	24.4	46.0	40.5
TOTAL	100	100.0	100.0	100.0

* Economic Regions I to VIII.
a/ 14/
b/ 15/

C. Costs

The Soviet literature states that the generation of electric power by hydrostations is much cheaper than generation by thermal plants. In 1958 such costs at point of manufacture represented less than 23 percent of cost of output by thermal stations. Implementation of the Seven Year Plan calls for a reduction in cost per kilowatt-hour of hydropower to only 15 percent of comparable cost by thermal stations.

TABLE 2-23

REGIONAL DISTRIBUTION
OF ELECTRIC POWER GENERATING
CAPACITY AND OUTPUT IN THE USSR a/
1958 - 1960

	1958		1959		1960	
	CAPACITY (M KVT*)	OUTPUT (B KWH*)	CAPACITY (M KVT*)	OUTPUT (B KWH*)	CAPACITY (M KVT*)	OUTPUT (B KWH*)
European USSR	33.4	142.1	37.0	160.4	41.0	174.8
Eastern Regions	20.2	93.3	22.3	104.7	25.7	117.5
TOTAL	53.6	235.4	59.3	265.1	66.7	292.3
	(PERCENT OF TOTAL)					
European USSR	62.3	60.4	62.4	60.5	61.5	59.8
Eastern Regions	37.7	39.6	37.6	39.5	38.5	40.2
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0

a/ 13/
* M Kvt = Million Kilovolts.
B Kwh = Billion Kilowatt-Hours.

TABLE 2-24

COMPARATIVE COST OF GENERATION
OF ELECTRIC POWER IN THE USSR
BETWEEN THERMAL AND HYDRO STATIONS
1955, 1958 AND 1965 PLAN
(Kopecks Per Kilowatt-Hour)

STATION	1955	1958	1965 PLAN
Thermal	1.000 a/	0.83 b/	0.60 b/
Hydro	0.206 c/	0.19 b/	0.09 b/
Hydro as Percent of Thermal	20.6	22.9	15.0

a/ 16/
b/ 17/
c/ 18/

Nevertheless, Khrushchev, in a speech given at the dedication of the Kuybyshev Dam on August 10, 1958, called for priority to be given to the construction of thermal plants, in order that the USSR could install capacity at a faster rate, thus to support the USSR in the program of catching up with and outstripping the U.S. Khrushchev recognized that to embark on this program was to deliberately accept an increase in costs of electric power, but that the desire to win time and to obtain the maximum increase in electric power generation far outweighed this cost disadvantage. (The surprisingly low reported cost of hydropower in relation to thermal power is believed to be due to the accounting practice of not charging any interest on the investment, although plant costs are apparently completely amortized.) Since that time, however, installation of new capacity at thermal electric power stations has not kept pace with the desired plan levels, but nevertheless represents the best results obtainable under current conditions.

Thermal electric power stations will throughout the Seven Year Plan continue to rely upon coal as the major source of fuel, although the share of coal in total fuel consumed is to decline from 76.6 percent in 1958 to 64.5 percent in 1965.

As shown in Table 2-25, most of the displacement of coal will be the result of increased deliveries of natural gas and petroleum (residual fuel oil) to thermal power plants.

TABLE 2-25

CONSUMPTION OF FUEL BY ELECTRIC POWER STATIONS OF THE USSR a/
1958 AND 1965 PLAN

	1958		1965 PLAN	
TYPE OF FUEL	MILLION METRIC TONS OF STANDARD FUEL	PERCENT OF TOTAL	MILLION METRIC TONS OF STANDARD FUEL	PERCENT OF TOTAL
Coal	95.8	76.6	150.2	64.5
Natural Gas	8.5	6.8	36.0	15.5
Petroleum	6.9	5.5	27.5	11.8
Peat	7.8	6.2	11.0	4.7
Shale	1.0	0.9	3.3	1.4
Other	5.0	4.0	5.0	2.1
TOTAL	125.0	100.0	233.0	100.0

a/ 19/

D. Consumption

In each of the past 10 years, industry has consumed about 65 to 67 percent of the total output of electric power in the USSR. Only about 11 percent of the total output is used for illumination and for the everyday needs of the population. The remainder of the available electric power is distributed fairly equally in meeting the needs of transport, consumption by the generating stations themselves and losses in the system. The consumption of electric power in the USSR, according to the consumer, for the years 1950 and 1955-60 is given in Table 2-26.

TABLE 2-26

CONSUMPTION OF ELECTRIC POWER IN THE USSR, BY CONSUMER a/
1950 AND 1955 - 1960

	INDUSTRY		TRANSPORT		ELECTRIC POWER STATIONS		LOSSES IN SYSTEM		OTHER b/		TOTAL	
YEAR	BKWH*	PERCENT OF TOTAL	BKWH*	PERCENT OF TOTAL	BKWH*	PERCENT OF TOTAL	BKWH*	PERCENT OF TOTAL	BKWH*	PERCENT OF TOTAL	BKWH*	PERCENT OF TOTAL
1950	60.6	66.4	2.6	2.9	5.2	5.7	6.3	6.9	16.5	18.1	91.2	100.0
1955	113.3	66.6	5.4	3.2	10.9	6.4	10.3	6.0	30.3	17.8	170.2	100.0
1956	126.9	66.2	6.5	3.4	12.1	6.3	11.8	6.2	34.4	17.9	191.7	100.0
1957	138.3	65.9	7.7	3.7	13.0	6.2	13.2	6.3	37.5	17.9	209.7	100.0
1958	154.2	65.5	9.2	4.0	14.6	6.2	14.7	6.2	42.7	18.1	235.4	100.0
1959	173.3	65.4	11.5	4.3	17.0	6.4	16.4	6.2	46.9	17.7	265.1	100.0
1960	190.5	65.2	14.2	4.8	18.3	6.3	17.8	6.1	51.5	17.6	292.3	100.0

* BKWH = Billion Kilowatt-Hours.
a/ 20/
b/ Including consumption by the communal economy, as shown in Table 2-27.

Distribution of consumption among the several sectors of the so-called communal economy of the USSR for 1950 and 1955-59 is given in Table 2-27.

TABLE 2-27

CONSUMPTION OF ELECTRIC POWER BY THE COMMUNAL ECONOMY OF THE USSR a/
1950, 1955-59
(Million Kilowatt-Hours)

YEAR	ILLUMINATION AND EVERYDAY NEEDS	STREETCARS AND BUSES	SUBWAYS	WATER AND SEWER LINES	TOTAL
1950	9,944.7	888.0	166.8	1,355.5	12,355.0
1955	16,485.0	1,377.0	311.0	2,193.8	20,366.8
1956	18,513.0	1,500.9	352.3	2,390.0	22,756.2
1957	20,101.9	1,621.7	361.5	2,650.8	24,735.9
1958	22,631.9	1,835.6	358.6	3,126.3	27,952.4
1959	24,777.6	2,005.0	433.8	3,193.3	30,409.7

a/ 21/

E. Plans For The Future

Examination of the meager data available on development of output of hydroelectric power in relation to expansion of the entire electric power industry for the twenty-year period ending in 1980 indicates that the Soviet Union has planned no revision of significance in this relationship. As shown in Table 2-28, the output of electric power from hydropower stations is to keep pace with the total generation of electric power. As a result the share of hydropower stations in the total output of electric power is to remain almost constant through 1980 within the range of 19 to 21 percent of the total.

TABLE 2-28

PLANNED OUTPUT OF
ELECTRIC POWER IN THE USSR
1970, 1975 AND 1980
(Billion Kilowatt-Hours)

YEAR	TOTAL	FROM HYDROPOWER STATIONS	HYDRO AS PERCENT OF TOTAL
1970	900-1,000 a/	190.0 b/	19-21.1
1975 Committee Estimate	1,700	330.0 b/	19.4
1980	2,700-3,000 a/	570.0 c/	19-21.1

a/ 22/
b/ 23/
c/ 24/

Implicit in the long range plans developed for the electric power industry of the USSR is the pronounced shift in regional demand for electric power, reflecting the general industrial expansion foreseen for the eastern regions. Implementation of these plans will bring about a rapid expansion of consumption of electric power in the eastern regions, to the effect that by 1980, almost equivalent amounts of electric power will be consumed in the European USSR (excluding the Urals) and in the eastern regions (excluding the Urals). The pattern of this shift is to be as follows: 25/

AREA	ELECTRIC POWER CONSUMPTION (As Percent of Total) 1958	1975	1980
European USSR	61.1	48.1	44.3
Urals	19.4	12.8	11.6
Eastern Regions	19.5	39.1	44.1
TOTAL	100.0	100.0	100.0

More electric power is to be made available to the population of the country for use in illumination, cooking and heating. The growth in the relative share of household use is to be made at the expense of relative deliveries to the industrial and construction sector, as shown by Table 2-29.

By 1980 the communal-everyday economy is to consume about 22 percent of total electric power output (Table 2-29), up from about 12 percent in 1959. (Tables 2-26 and 2-27).

TABLE 2-29

PLANNED CONSUMPTION OF ELECTRIC POWER IN THE USSR, BY CONSUMER a/
1965, 1970, 1975 AND 1980
(Percent of Total)

CONSUMER	1965	1970	1975	1980
Industry and Construction	68.0	65.0	65.0	59.6
Transport	6.0	6.5	6.0	4.4
Commercial - Everyday needs of urban areas	9.0	9.7	11.0	17.1
Agriculture	4.0	6.0	6.0	6.6
(Including commercial - everyday needs of rural areas)	(not given)	(3.5)	(3.7)	(4.8)
Losses and Station Use	13.0	12.8	12.0	12.3
TOTAL	100.0	100.0	100.0	100.0

a/ 26/

Per capita consumption of electric power in the USSR for all purposes is to increase from 180 kilowatt-hours in 1960 to about 1,900 kilowatt-hours in 1980. If this level is reached, then the USSR will have succeeded in supplying to its people slightly more electric power per capita than the U.S. electric power industry provided per capita in 1960.

CHAPTER III

USSR PETROLEUM (CRUDE OIL AND NATURAL GAS)

CHAPTER III

USSR PETROLEUM (CRUDE OIL AND NATURAL GAS)

SECTION 6

PROSPECTIVE SEDIMENTARY AREAS

Latest Soviet estimates 1/ place the known oil-gas bearing and prospective sedimentary areas of the Soviet Union at 11.3 million kilometers (4.36 million square miles). The Committee, with less than complete data, has made an inde-penpendent study of the sedimentary areas of the USSR and has arrived at an estimate for the prospective areas of 10.3 million square kilometers (3.98 million square miles) or about 9 percent less than the Soviet estimate. This estimate does not include basin areas that the Committee condemned as being non-prospective.

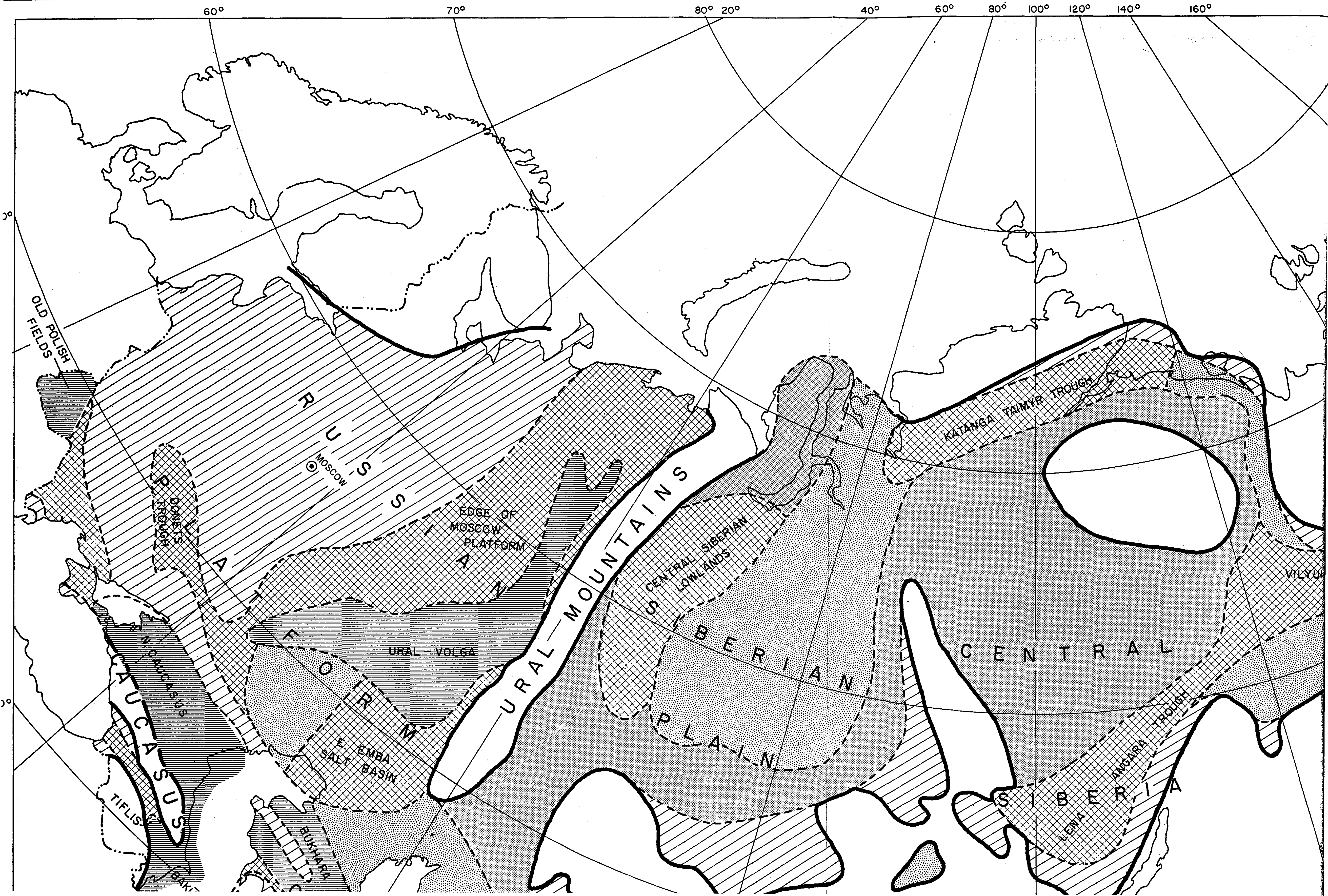
The prospective area that the Committee estimated as 10.3 million square kilometers has been divided into four classifications as shown on Map No. 2. The relative sizes of these classes as determined from the map are as follows:

AREA CLASS	DESCRIPTION	MILLION SQUARE KILOMETERS	MILLION SQUARE MILES	PERCEN. OF TOTAL
A	Areas of developed substantial production where comparable new fields may be found, or areas into which similar good productive trends are believed to extend.	1.46	0.56	10.3
B	Areas of developed but mediocre production and reserves in which only comparable results can be be expected in the future, or new areas with limited objectives (poor traps or single pay objective).	3.31	1.28	23.2
C	Areas without fields but having hydrocarbon indications and small productive possibilities.	2.59	1.00	18.2
	TOTAL FAVORABLE AREA	7.36	2.84	51.7
D	Basin areas of unknown or poor prospects.	2.95	1.14	20.8
	TOTAL PROSPECTIVE AREA	10.31	3.98	72.5
E	Basin areas considered non-prospective.	3.91	1.51	27.5
	TOTAL BASIN AREA	14.22	5.49	100.0

The magnitude of the sedimentary area of the Soviet Union is indeed impressive. Areas which are suitable for the occurrence of petroleum in the USSR extend from the Soviet-Iranian border in the south to the Arctic Ocean in the north, and from the Western Ukraine across the Caspian Sea to the Pacific. It is of interest to compare this area with that of the U.S., thus far the leading producer of crude oil. The favorable sedimentary area of the U.S., including Alaska and the Continental Shelf (to a depth of 600 feet) is estimated at 2.12 million square miles. It is believed that Classes A through C in the above tabulation for the USSR, which total 2.84 million square miles, can be roughly compared to the 2.12 million square miles in the U.S.

Thus the Committee concludes that the Soviet petroleum production levels will not be limited by geological factors for many years.

AP NO. 2



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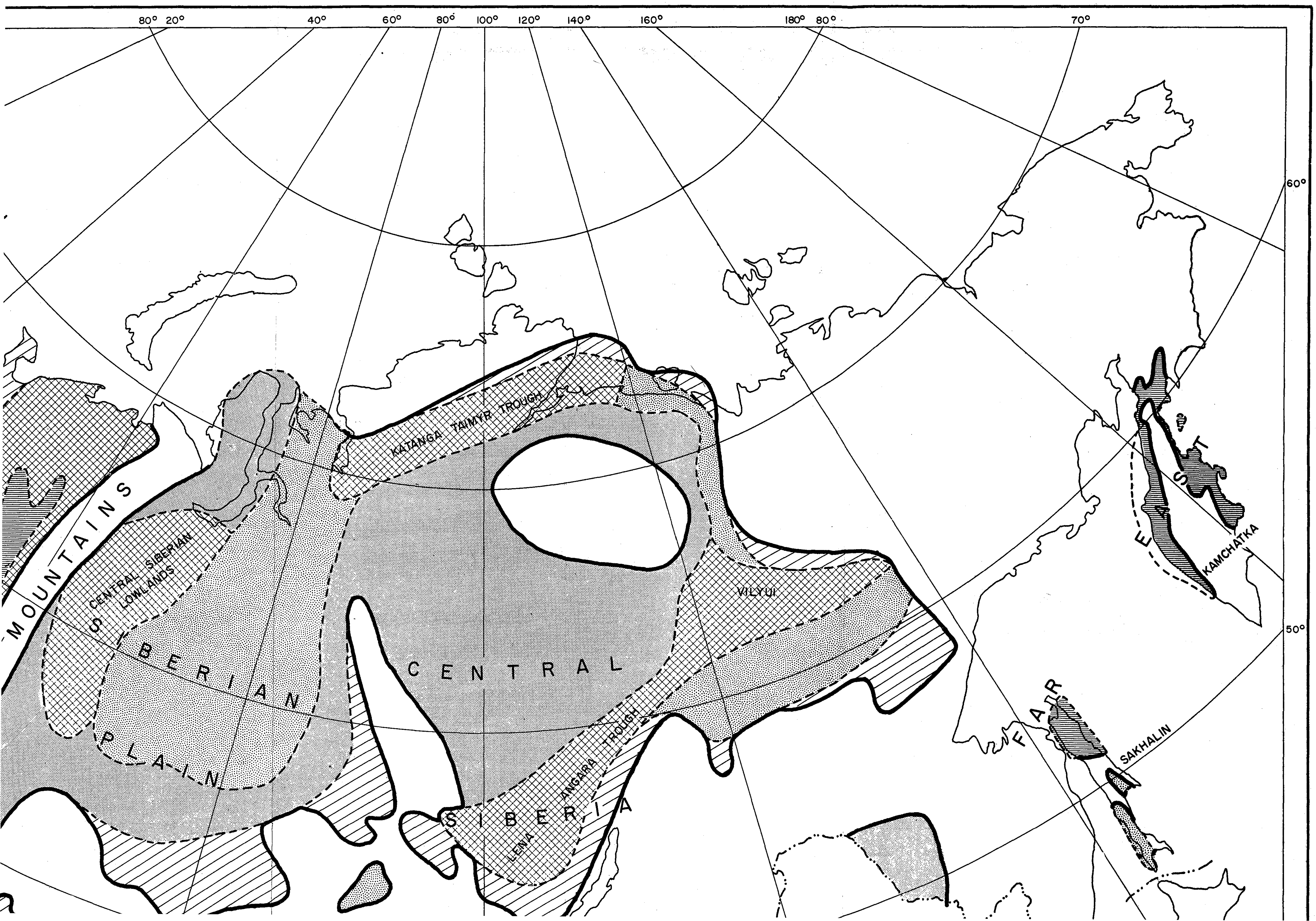
OLD POLISH FIELDS
RUSSIAN PLATFORM
MOSCOW
DONETS TROUGH
EDGE OF MOSCOW PLATFORM
URAL - VOLGA
N. CAUCASUS
CAUCASUS
E. EMBA SALT BASIN
TIFLIS
BUKHARA
URAL MOUNTAINS
CENTRAL SIBERIAN LOWLANDS
SIBERIAN PLAIN
KATANGA TAIMYR TROUGH
CENTRAL
SIBERIA
LENA ANGARA TROUGH



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MOUNTAINS
CENTRAL SIBERIAN LOWLANDS
SIBERIAN PLAIN
KATANGA TAIMYR TROUGH
VILYUI
CENTRAL SIBERIA
LENA ANGARA TROUGH
KAMCHATKA
FAR EAST
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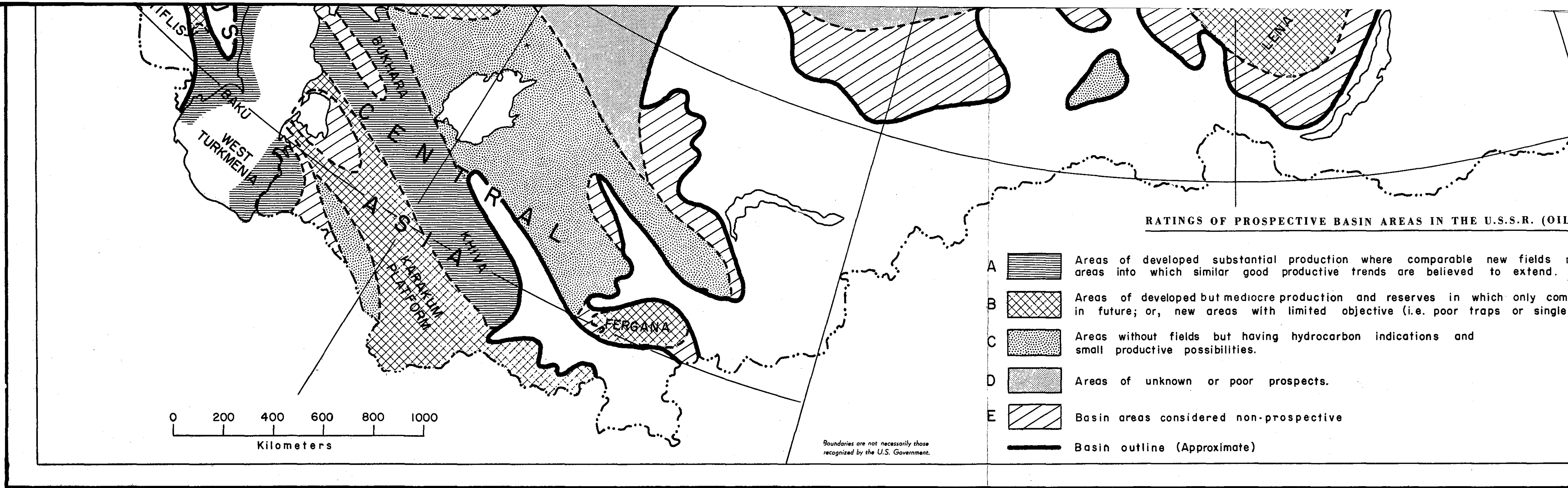
TIFLIS
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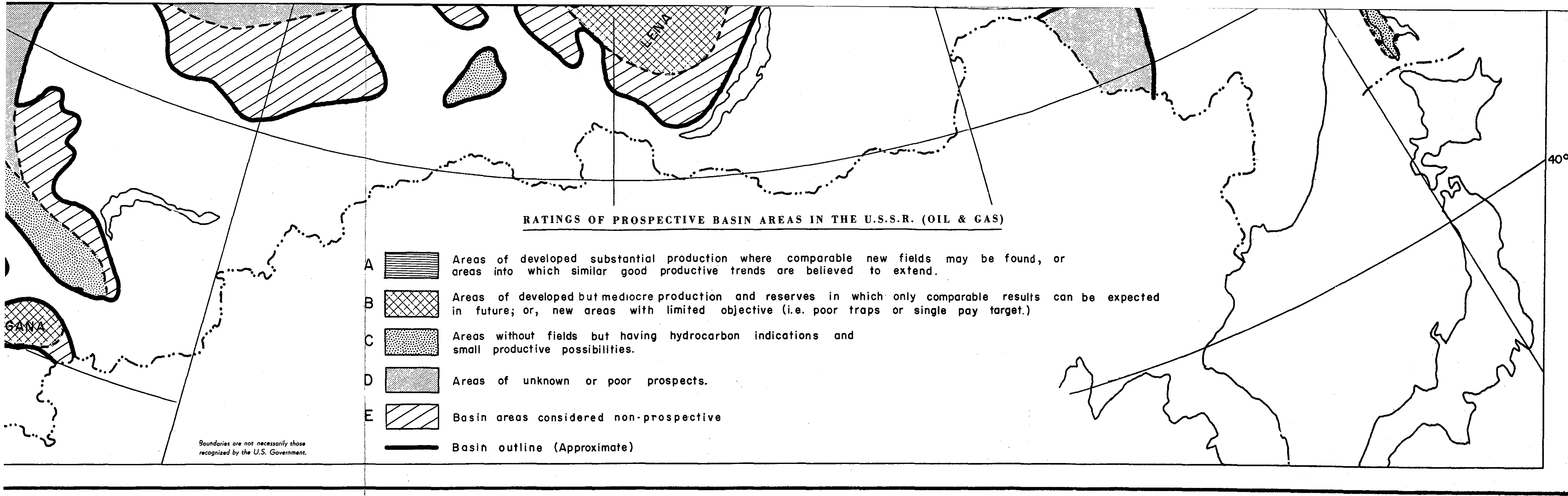
0 200 400 600 800 1000
Kilometers
Boundaries are not necessarily those recognized by the U.S. Government.
RATINGS OF PROSPECTIVE BASIN AREAS IN THE U.S.S.R. (OIL
A Areas of developed substantial production where comparable new fields m
areas into which similar good productive trends are believed to extend.
B Areas of developed but mediocre production and reserves in which only comp
in future; or, new areas with limited objective (i.e. poor traps or single
C Areas without fields but having hydrocarbon indications and
small productive possibilities.
D Areas of unknown or poor prospects.
E Basin areas considered non-prospective
Basin outline (Approximate)


RATINGS OF PROSPECTIVE BASIN AREAS IN THE U.S.S.R. (OIL & GAS)
A Areas of developed substantial production where comparable new fields may be found, or areas into which similar good productive trends are believed to extend.
B Areas of developed but mediocre production and reserves in which only comparable results can be expected in future; or, new areas with limited objective (i.e. poor traps or single pay target.)
C Areas without fields but having hydrocarbon indications and small productive possibilities.
D Areas of unknown or poor prospects.
E Basin areas considered non-prospective
Basin outline (Approximate)
Boundaries are not necessarily those recognized by the U.S. Government.
LENA
GANA
40°

SECTION 7

GEOPHYSICAL AND CORE-DRILLING ACTIVITIES

In its search for oil, the Soviet Union relies heavily on core drilling and geophysical techniques of prospecting. Core drilling has been and will continue to be a popular method of preparing structures for exploratory drilling. This method affords a simple, economical, and reliable technique for evaluating shallow oil and gas prospects. Table 3-1 shows that 3.65 million meters of core drilling was effected in 1961, and the volume planned is to increase to 6 million meters by 1965.

TABLE 3-1

CORE DRILLING IN THE USSR a/
1951-61 AND PLANS FOR 1962 AND 1965
(Thousand Meters)

YEAR	VOLUME
1951	1,454.5
1952	1,780.3
1953	2,165.3
1954	2,253.6
1955	2,187.3
1956	2,396.3
1957	2,800.0
1958	3,041.0
1959	3,238.0
1960 (Estimate)	3,400.0
1961	3,650.0 b/
1962 Plan	4,050.0 b/
1965 Plan	6,000.0 c/

a/ Except where noted, from 1/.
b/ 2/
c/ 3/

Thus, according to the Seven Year Plan, the annual amount of core drilling is to almost double. Nevertheless, the relationship between core drilling and exploratory drilling is to decline during this period. For one meter of exploratory drilling in 1952-58, there was carried out 0.9 meters of core drilling. For the 7-year period 1959-65, the relationship will decline to 0.68 meters of core drilling for one meter of exploratory drilling, if the plan is met. 4/

At the same time, the average depth of core wells drilled is planned to increase, from 502 meters in 1958 to 935 meters in 1965. 5/ In this, the share of core wells with depths of up to 500 meters is to decline from 60 percent in 1958 to 18 percent in 1965 and the share of wells with depths from 500 meters to 1,200 meters is to increase from 31 percent to 46 percent.

The geophysical techniques of prospecting have become more important as the search has progressed to deeper fields and into the flat regions of the Volga River, the Pri-Caspian Plain, and the vast timber-covered areas of Western Siberia, where geological surface indications are not prominent. The number of geophysical parties, and in particular of seismic crews, has been rapidly expanded as the rate of exploration increased in the geologically blind areas. By 1961, there were reported 850 seismic parties, 200 electric parties, and 100 gravity parties in operation. About 600 areas were under exploration. Expansion of effort to 1,200 seismic crews is planned by 1965. The actual growth of the geophysical effort, covering the years 1946 to 1961, with estimates for 1965, is shown in Table 3-2.

Many prospective areas of the Soviet Union are in deserts, the forests of Siberia, or other regions lacking good accessibility. The progress in such areas is slow and requires a greater number of parties for exploration. It is significant that the USSR has more geophysical crews in operation than the entire Free-World.

TABLE 3-2

GEOPHYSICAL FIELD CREWS IN THE USSR,
ACCORDING TO METHOD OF SEARCH
1946, 1950, 1955-59, 1961 AND 1965 ESTIMATE

METHOD	1946 a/	1950 a/	1955 a/	1956 b/	1957 b/	1958 b/	1959 b/	1961 c/	1965
Seismic	24	118	250	309	371	432	499	850	1,200 d/
Electric	37	88	68	79	90	92	93	200	250 e/
Gravimetric	30	52	107	123	133	143	156	100	200 e/
Magnetic	16	21	4	6	6	6	6	6	12 e/
Airborne Magnetometer	0	0	6	6 a/	0 f/	8 g/	10 e/	12 e/	20 e/
TOTAL	107	279	435	523	600	681	764	1,168	1,682
Supporting h/	85	292	330	393 a/	370 a/	NA	NA	NA	NA
GRAND TOTAL	192	571	765	916	970	NA	NA	NA	NA

a/ 6/
b/ 7/
c/ 8/
d/ 9/
e/ Committee estimate.
f/ 10/
g/ 11/
h/ Field-geophysical parties. Of these, gas well-logging parties totalled 180 at the beginning of 1955.

SECTION 8

DRILLING

A. Exploration

Although not definitely stated in the Russian literature, it is apparent that the Soviets use generally the same definitions to classify a well as those used in the U.S. oil industry. The major difference appears to be in the practice of delineation drilling after a discovery. In the U.S., wells after discovery are generally classed as development wells. In the Soviet Union, delineation drilling after discovery is classed as exploratory drilling. The Soviet classification is that which has been used throughout this report.

In terms of annual volume, exploratory drilling exceeded that for development drilling for the first time in 1959, which was in line with the general trend established for the Seven Year Plan. In the Seven Year Plan there is to be almost 1.5 meters of exploratory drilling for each meter of development drilling. But for the twenty-year period 1961-80, emphasis is to shift again to development drilling and it is estimated that during these years the volume of exploratory drilling will be about one-half of development drilling.

As a share of total exploratory drilling, those volumes allocated by Soviet planners to natural gas have been steadily increasing, from 16 percent in 1955 to 33 percent in 1961. For the years 1959-65, exploratory drilling allocated by the planners for natural gas is to represent about 44 percent of all exploratory drilling and for the period 1961-80, it will be 55 percent. Exploratory drilling for oil and gas during the years 1950-61, and plans for 1962, 1965, 1959-65, and 1961-80 are given in Table 3-3.

Distribution of exploratory drilling during 1920-58 by area of the USSR underlines the concentration of drilling in the Urals-Volga, the North Caucasus and Azerbaydzhan and the lack of attention which has been given so far to the exploration for oil and gas in the regions of Siberia, where more than 48 percent of the prospective sedimentary area is be found. (See Table 3-4)

TABLE 3-3

EXPLORATORY DRILLING FOR OIL AND GAS IN THE USSR
1950-61, PLANS FOR 1962, 1965, AND 1961-80
(Thousands of Meters)

YEAR	CRUDE OIL	NATURAL GAS	TOTAL
1950 a/	1,980.3	147.0	2,127.3
1951 a/	2,170.7	204.5	2,375.2
1952 a/	2,088.2	191.0	2,279.2
1953 a/	2,250.9	230.7	2,481.6
1954 a/	2,018.1	249.4	2,267.5
1955 a/	1,916.6	325.0	2,241.6
1956 a/	1,999.0	315.0	2,314.0
1957	2,266.3 b/	602.0 c/	2,868.3 d/
1958	2,628.0 b/	741.0 c/	3,369.0 d/
1959	2,822.0 b/	940.0 c/	3,762.0 d/
1960	3,038.0 b/	1,012.0 c/	4,050.0 d/
1961	3,030.6 b/	1,500.4 e/	4,531.0 f/
1962 Plan	NA	NA	5,150.0 f/
1965 Plan	6,705.0 b/	3,407.0 g/	10,112.0 h/
1959-65 Plan	34,140.0 b/	15,000.0 g/	49,140.0 i/
1961-80 Plan	78,430.0 j/	86,570.0 k/	150-180,000.0 l/

a/ 1/
b/ By difference.
c/ 2/
d/ 3/
e/ 4/
f/ 5/
g/ 6/
h/ 7/
i/ 8/
j/ By difference, based on the midpoint of the 1961-80 range.
k/ 9/
l/ 10/

TABLE 3-4

DENSITY OF EXPLORATORY DRILLING ACCORDING TO SELECTED AREAS OF THE USSR a/ - 1920-58

AREA	EXPLORATORY DRILLING (THOUSAND METERS)	EXPLORATORY DRILLING PERCENT OF TOTAL	PROSPECTIVE SEDIMENTARY AREA b/ (THOUSAND SQUARE KILOMETERS)	PROSPECTIVE SEDIMENTARY AREA b/ PERCENT OF TOTAL	DENSITY OF DRILLING (METERS PER SQUARE KILOMETER)
TOTAL USSR	33,866	100.0	11,300	100.0	3.00
SELECTED AREAS					
Urals-Volga	10,742	31.7	684	6.1	15.70
North Caucasus	7,743	22.9	250	2.2	31.00
Azerbaydzhan	6,566	19.4	50	0.4	131.30
Siberia	922	2.7	5,460	48.3	0.17

a/ 11/

b/ Note that this is from USSR sources. The Committee's estimate of total prospective sedimentary area for the USSR of 10.3 million square kilometers compares with the 11.3 million square kilometers shown here.

Considerable difficulty has been encountered in the attempt to meet the annual goals for drilling of exploratory wells. The problem areas appear to be (1) the poor quality of bits, (2) the poor quality of drill pipe and (3) low efficiency of the turbodrill at increased depths. As a consequence, not a single annual goal for exploratory drilling has been met during the five-year period 1957-61, as illustrated in Table 3-5. For the first two years of the Seven Year Plan, reported exploratory drilling volumes represented less than 88 percent of plan, or a cumulative shortfall of 1,070 thousand meters. Of this shortfall, 473 thousand meters were to have been expended in the drilling for natural gas, and the remainder--597 thousand meters--for crude oil, as shown in the following:

	(THOUSAND METERS)					
	1959			1960		
YEAR	PLAN	ACTUAL	SHORTFALL	PLAN	ACTUAL	SHORTFALL
Crude Oil	3,144a/	2,822a/	322	3,313a/	3,038a/	275
Natural Gas	1,130b/	940c/	190	1,295d/	1,012c/	283
TOTAL	4,274e/	3,762e/	512	4,608e/	4,050e/	558

a/ By difference
b/ 17/
c/ Derived from Table 3-3
d/ 18/
e/ Derived from Table 3-5

The plan for exploratory drilling in 1961 was unfulfilled to the extent of 8.2 percent. Thus, for the three years 1959-61, the cumulative plan for exploratory drilling was met by only 89.3 percent. Despite these shortcomings, Soviet authorities claim that the scheduled increments to proved reserves of crude oil and natural gas were attained for these years. (See page 119 and following for discussion of additions to proved reserves of natural gas.) Certainly, a significant portion of these increments resulted from more intensive use of water flooding.

TABLE 3-5

REPORTED VS. PLANNED EXPLORATORY DRILLING IN THE USSR - 1957-61
(Thousands of Meters)

YEAR	PLAN	REPORTED a/	REPORTED AS PERCENT OF PLAN
1957	3,800 b/	2,868	75.5
1958	3,711 c/	3,369	90.8
1959	4,274 d/	3,762	88.0
1960	4,608 e/	4,050	87.9
1961	5,100 f/	4,531	88.8

a/ Derived from Table 3-3.
b/ 12/
c/ 13/
d/ 14/
e/ 15/
f/ 16/

Exploratory drilling for natural gas has been particularly effective so far in the Soviet Union. As shown in Table 3-6, it was reported that for each meter of exploratory drilling for natural gas during the period 1951-55, 304.6 thousand cubic meters of natural gas were found, and for the subsequent five-year period 1956-61, 335.4 thousand cubic meters of natural gas were found per meter of exploratory drilling. The original plan covering 1959-65 calls for a decline in the effectiveness of exploratory drilling for natural gas, to 240 thousand cubic meters per meter of exploratory drilling, but there is some evidence to indicate that the volume of exploratory drilling for natural gas may be reduced by about 20 percent and at the same time, that the goal for proved reserves has been revised upward which would indicate a level of effectiveness approximately midway between the 1951-55 level and the 1956-61 level.

Lacking published Soviet data, the Committee has estimated proved reserves assuming that the crude oil proved reserves/ production ratio remained at 20 to 1 for the period 1950-60, In the light of authoritative Soviet statements regarding the rate of depletion of major oil fields, this is a logical assumption to make. On this basis, for the period 1951-55, for each meter of exploratory drilling there was found 89.1 tons of crude oil. In the subsequent five-year period 168.5 tons of crude oil were found for each meter of exploratory

TABLE 3-6

EFFECTIVENESS OF EXPLORATORY DRILLING FOR NATURAL GAS IN THE USSR
1951-1961 AND 1959-1965 PLAN

YEAR	EXPLORATORY DRILLING FOR NATURAL GAS a/ (THOUSAND METERS)	NET INCREMENTS TO PROVED RESERVES b/ (BILLION CUBIC METERS)	ANNUAL PRODUCTION OF NATURAL GAS* c/ (BILLION CUBIC METERS)	GROSS ADDITIONS TO PROVED RESERVES (BILLION CUBIC METERS)	EFFECTIVENESS OF EXPLORATORY DRILLING (THOUSAND CUBIC METERS PER METER DRILLED)
1951-55	1,200.0	342.7	22.872	365.572	304.6
1956	315.0	96.4	8.039	104.439	331.6
1957	602.0	111.0	14.095	125.095	207.7
1958	741.0	289.4	22.522	311.922	420.9
1959	940.0	696.6	28.863	725.463	771.8
1960	1,012.0	226.0	37.213	263.213	260.1
1961	1,500.4	133.2	51.000 (Estimate)	184.200	122.8
1956-1961	5,110.4	1,532.6	161.732	1,714.332	335.4
1959-1965 Plan d/	15,000.0	3,040.0	558.692	3,598.700	240.0

* Non-associated natural gas.
a/ Derived from Table 3-3.
b/ Derived from Table 3-35.
c/ Derived from Tables 3-28 and 3-32.
d/ 19/

drilling. Analysis of the plans for the years 1959-65 indicates that the effectiveness of exploratory drilling for crude oil for these years is to fall back to about the 1951-55 level, as illustrated by Table 3-7.

Because of the classification of exploratory drilling in the USSR, Soviet authorities can claim a very high ratio of successful exploratory wells compared to total exploratory wells drilled. Thus, the USSR is able to show that in 1960, for example, 44.1 percent of the number of exploratory wells drilled and tested in that year produced either crude oil or natural gas (See Table 3-8).

B. Development

Difficulties similar to those in the exploratory drilling program also have prevented Soviet drillers from achieving the planned volumes of development drilling for the first three years of the Seven Year Plan. In these years, the cumulative plan fulfillment was only 94.6 percent, although, as shown in Table 3-9, the annual plan for 1960 actually was exceeded. The success in this year was offset by a very poor performance in 1959.

At least through 1965, emphasis is to be shifted away from development drilling to exploratory drilling. In 1965, the volume of development drilling is to be equivalent to less than 59 percent of exploratory drilling planned for that year. For the twenty-year period 1961-80, however, it is apparent that emphasis again has been given to development drilling and during these years, there is to be about 2 meters of development drilling for one meter of exploratory drilling. The volumes of development drilling for oil and gas during 1950-61 and plans for 1962, 1965, 1959-65 and 1961-80 are given in Table 3-10.

As shown in Table 3-10, only a small portion of the annual volumes of development drilling have been allocated to natural gas. In 1956, the last year for which data are available, development drilling for natural gas represented only 1.7 percent of total development drilling. For the Seven Year Plan, 7.6 percent of the planned development drilling has been allocated to natural gas, but for the period 1961-80, it is estimated that only slightly more than 3 percent of the total for

TABLE 3-7

EFFECTIVENESS OF EXPLORATORY DRILLING FOR CRUDE OIL IN THE USSR
1951-55, 1956-60 AND 1959-65 PLAN

PERIOD	EXPLORATORY DRILLING FOR CRUDE OIL a/ (THOUSAND METERS)	NET INCREMENT TO PROVED RESERVES (MILLION METRIC TONS)	CUMULATIVE PRODUCTION OF CRUDE OIL (MILLION METRIC TONS)	GROSS ADDITIONS TO PROVED RESERVES (MILLION METRIC TONS)	EFFECTIVENESS OF EXPLORATORY DRILLING (TONS PER METER DRILLED)
1951-55	10,444.5	658 b/	272.4 c/	930.4	89.1
1956-60	12,753.3	1,542 b/	572.8 c/	2,114.8	165.8
1959-65 Plan	34,140.0	1,584 d/	-	-	-
Based on production of 240 million metric tons in 1965.			1,295.0 e/	2,879.0	84.3
Based on production of 265 million metric tons in 1965.			1,345.0 e/	2,929.0	87.2

a/ Derived from Table 3-3.
b/ Assumed proved reserves/production ratio of 20-1.
c/ Derived from Table 3-18.
d/ According to plan the proved reserves of crude oil in 1965 are to exceed the 1958 level by 1.7 times.
e/ Estimate.

TABLE 3-8

SUCCESS OF EXPLORATORY DRILLING IN THE USSR
1951-58 AND 1960

YEAR	NUMBER OF EXPLORATORY WELLS DRILLED	NUMBER OF EXPLORATORY WELLS TESTED	NUMBER OF EXPLORATORY WELLS YIELDING OIL OR GAS			PRODUCING EXPLORATORY WELLS AS PERCENT OF THOSE TESTED
			OIL	GAS	TOTAL	
1951 a/	NA	1,219	400	100	500	41.0
1952 a/	NA	1,372	469	105	574	41.8
1953 a/	NA	1,337	509	127	636	47.6
1954 a/	NA	1,421	569	136	705	49.6
1955 a/	NA	1,394	563	135	698	50.1
1956 b/	1,225	1,153	466	115	581	50.4
1957 b/	1,435	1,387	595	121	716	51.6
1958 b/	1,627	1,517	585	163	748	49.3
1960 b/	1,956	1,831	NA	NA	808	44.1

a/ 20/
b/ 21/

development drilling will be used to provide an expansion in the natural gas producing base.

TABLE 3-9

REPORTED VS. PLANNED DEVELOPMENT
DRILLING IN THE USSR - 1957-61
(Thousands of Meters)

YEAR	PLAN	REPORTED a/	REPORTED AS PERCENT OF PLAN
1957	3,240 b/	3,288	101.5
1958	3,572 c/	3,518	98.5
1959	4,094 d/	3,386	82.7
1960	3,516 e/	3,700	105.2
1961	3,900 f/	3,800	97.4

a/ Derived from Table 3-10
b/ 22/
c/ 23/
d/ 24/
e/ 25/
f/ 26/

C. Drilling Equipment

Most of the drilling in the Soviet Union today is done by the turbodrill technique. The Soviet turbodrill is a post-World War II development. In the pre-war years, the turbodrill was still considered an experimental tool and accounted for less than 5 percent of the drilling, but following the war Russian engineers were successful in developing mud-lubricated rubber bearings which markedly improved turbine performance and prompted a rapid rise in the use of turbodrills. The equipment provided an efficient and economical technique for drilling to moderate depths, and reduced the incentive for importing from the West drill pipe and tool joints of higher quality than domestic manufacturers were able to supply. With turbodrilling, the USSR was able to greatly reduce the fishing jobs when using the inferior domestic drill pipe, and drilling speed per rig was increased. By 1950, about 24 percent of the total drilling was done by the turbodrill method, and in 1960, 85 percent to 90 percent of total volume was effected by turbodrilling.

TABLE 3-10

DEVELOPMENT DRILLING FOR OIL AND GAS IN THE USSR
1950-61, PLANS FOR 1962, 1965, 1959-65 AND 1961-80
(Thousands of Meters)

YEAR	CRUDE OIL	NATURAL GAS	TOTAL
1950 a/	2,124.0	31.3	2,155.3
1951 a/	2,320.9	11.1	2,332.0
1952 a/	2,588.6	37.2	2,625.8
1953 a/	2,857.5	22.8	2,880.3
1954 a/	2,647.4	25.3	2,672.7
1955 a/	2,729.3	41.2	2,770.5
1956 a/	2,727.0	48.0	2,775.0
1957	NA	NA	3,288.2 b/
1958	NA	NA	3,518.0 b/
1959	NA	NA	3,386.0 b/
1960	NA	NA	3,700.0 b/
1961	NA	NA	3,800.0 c/
1962 Plan	NA	NA	4,150.0 d/
1965 Plan	NA	NA	5,930.0 e/
1959-65 Plan	30,360.0 f/	2,500.0 g/	32,860.0 h/
1961-80 Plan	315,000.0 i/	10,000.0 j/	325,000.0

a/ 27/
b/ 28/
c/ 29/
d/ 30/
e/ 31/
f/ By difference.
g/ 32/
h/ 33/
i/ Estimate. A total of 150,000 exploitational and supporting wells is to be drilled during 1961-80. 34/ An average depth of 2,100 meters per well has been assumed.
j/ Estimate based relationship exhibited between exploratory drilling and development drilling for natural gas.

The USSR has exported very few of its turbodrills to other countries of the Sino-Soviet Bloc. For the six-year period 1955-60, a total of 916 turbodrills (see Table 3-11) were exported to other Bloc countries. This export represented only 3.8 percent of the production of turbodrills in these years. Almost two-thirds of such exports in 1960 were made to China and for the years 1955-60, deliveries of turbodrills to China accounted for more than 40 percent of the total turbodrills exported by the USSR.

By 1957, with average exploration well depths exceeding 1,800 meters, (see Table 3-13) weaknesses in the turbodrilling technique began to appear. The result was that the drilling rates began to level off after having previously shown a general improvement. Table 3-12 shows that in 1957 and 1958 rates levelled off at about 1,082 to 1,084 meters per rig per month in development drilling; and since then have declined by about 11 percent to 966 meters per rig in 1961. Similarly, exploratory drilling rates levelled off in 1958-59 at about 417 to 419 meters per rig per month and in 1960 declined to the 1957 level, and further to 397 meters per rig-month in 1961. Difficulties developed as needs arose to pump drilling fluids to lower depths and as drilling formations began to require a better quality of drilling muds. Both of these requirements increased friction losses and thus reduced the performance of bits and rigs. The resulting failure to increase the efficiency of the rig utilization during this period has prompted some reorientation in turbodrill thinking which has led to a redesign of the turbodrills, to the development of smaller diameter turbodrill units, and to research to develop the electrodrill.

As evidence of turbodrill difficulties persisted, the Soviet engineers began to recommend limiting the turbodrill technique to 2,000 meters in depth and suggesting the electrodrill technique for deeper drilling.

Although it has certain advantages over the turbodrill, primarily in increased rates and reduced costs, the electrodrill appears to have its own disadvantages. These are found in the transmission of electric power to the bottom hole motor, in keeping break-and-make cable connections leakproof, in overcoming higher friction losses inside of the drill pipe and in making electric motors operable at bottom hole temperatures. Thus far Soviet technical publications have been releasing favorable comparisons between the electrodrill and the turbodrill, and plans have been made to increase electrodrilling volume to 15

TABLE 3-11

PRODUCTION AND EXPORTS OF TURBODRILLS IN THE USSR - 1955-60

YEAR	PRODUCTION (UNITS)	EXPORTS (UNITS)	EXPORTS (AS PERCENT OF PRODUCTION)
1955	2,589 a/	46 c/	1.8
1956	2,772 b/	148 c/	5.3
1957	3,489 b/	210 c/	6.0
1958	4,213 a/	99 c/	2.3
1959	4,898 a/	171 c/	3.5
1960	6,222 a/	242 d/	3.9
TOTAL	24,183	916	3.8

a/ 35/ c/ 37/
b/ 36/ d/ 38/

TABLE 3-12

EXPLORATORY AND DEVELOPMENT DRILLING RATES IN THE USSR - 1950, 1955-61 AND 1965 PLAN a/
(Meters Per Rig-Month)

YEAR	EXPLORATORY	DEVELOPMENT
1950	208.7	629.4
1955	305.7	893.3
1956	336.8	942.9
1957	400.5	1,082.0
1958	416.6	1,083.9
1959	419.0	995.6
1960	400.0	994.0
1961 b/	397.0	966.0
1965 Plan c/	780.0	1,767.0

a/ Except where noted, from 44/.
b/ 45/
c/ 46/

percent of total drilling by 1965. Nevertheless, at present the electrodrill accounts for only 2 to 3 percent of the annual volume of drilling; and there are no more than 20 electrodrills in use in the USSR. 47/

TABLE 3-13

AVERAGE DEPTHS OF WELLS IN THE USSR
SELECTED YEARS 1950-80
(Meters)

YEAR	EXPLORATORY	DEVELOPMENT
1950 a/	1,349	1,146
1955 b/	1,748	1,454
1956 b/	1,790	1,441
1957 b/	1,832	1,478
1958 b/	1,857	1,607
Urals-Volga		
Bashkir ASSR	1,789	1,816
Tatar ASSR	1,722	1,773
Kuybyshev Oblast	1,807	1,725
Perm Oblast	1,810	1,529
Saratov Oblast	1,873	1,952
Stalingrad Oblast	1,889	1,246
Azerbaydzhan	2,619	1,424
Turkmen	2,357	1,543
Uzbek	1,373	881
Kirgiz	2,284	2,293
Ukraine	1,941	1,731
1965 Plan c/	2,367	1,897
1961-80 Estimate	2,750 d/	2,100 c/ e/

a/ 39/
b/ 40/
c/ 41/
d/ 42/
e/ 43/

The number of exploratory and development drilling rigs in use in the USSR has increased from 1,135 rigs in 1950 to an estimated 1,279 rigs in 1961, approaching that number of rigs--1,360--planned for 1965. Because it is unlikely that the planned drilling rates for 1965 will be met, rig requirements in that year undoubtedly will exceed the 1965 plan requirements given in Table 3-14. An arbitrary calculation, using 1965 planned levels of drilling but 1960 drilling rates, indicates a 1965 rig requirement almost double that planned. On the other hand, it has been estimated elsewhere in this report that achievement of the 1965 drilling levels is not probable. Nevertheless, the 1965 rig requirements will exceed that planned, which may lead to shortages, particularly in heavy varieties, if rig manufacture plans are not altered. It seems likely, however, that the plans for drilling rig manufacture have been increased, since hoped for improvements in drilling rates have not materialized. Alternatively (or perhaps in combination with revised rig manufacturing plans) the USSR may look to Western supplies of equipment. The number of exploratory and development drilling rigs in use in the USSR in 1950, 1955-60 and that required for 1965 drilling plans is given in Table 3-14.

TABLE 3-14

ESTIMATED NUMBER OF EXPLORATORY AND DEVELOPMENT DRILLING RIGS IN USE IN THE USSR a/
1950, 1955-61 AND 1965 PLAN

YEAR	EXPLORATORY	DEVELOPMENT	TOTAL
1950	849	286	1,135
1955	611	259	870
1956	565	246	811
1957	597	253	850
1958	674	270	944
1959	748	283	1,031
1960	844	310	1,154
1961	951	328	1,279
1965 Plan b/	1,080	280	1,360
	2,107 c/	497 c/	2,604 c/

a/ Obtained by expanding the drilling rates given in Table 3-12 to a meters/year rate, then dividing the annual volumes of exploratory and development drilling (Tables 3-3 and 3-10) by the appropriate annual drilling rate.
b/ Calculated by using 1965 Planned drilling volumes and rates.
c/ Calculated by using 1965 planned drilling volumes and 1960 reported drilling rates.

In addition to those rigs actually in use, reports indicate that in 1960 there was a large number--on the order of 1,000--of idle rigs which, for all practical purposes, were obsolete. To replace those obsolete rigs and to allow for the introduction of more modern equipment, the USSR plans to produce 3,000 drilling rigs during 1959-65.[48/]

For the most part, Soviet rigs now in operation are suitable for drilling up to 2,000 meters in depth. They have lifting hook capacities of from 75 to 130 tons and are powered with either diesel or electric motors up to 800 H.P. The larger rigs are equipped with 450 H.P. pumps. The development rigs in this category are identified by series designations 3-D, 5-D, 4-E, and 6-E. In drilling to moderate depths they are capable of rates of 1,000 to 1,500 meters per month per rig. As the drilling progresses below 2,000 meters, however, the rate of penetration falls to 50-70 meters per month per rig. To improve drilling efficiency below 2,000 meters, the industry produced heavier rigs designated as 9-D and 11-DE, with pump working pressures of 2,500 to 3,000 pounds per square inch. Subsequently, a new series of drilling rig was designed and approved for introduction in the 1959-1965 period. This group, known as the BY-50 to BY-300 series, and equipped with traveling hook capacities of from 50 to 300 tons, respectively, was designed for drilling from 1,000 to 7,500 meters in depth. By 1965, lighter rigs of this series are scheduled to replace some 200 of the older rigs now in use in development drilling. The heavier rigs of the series are scheduled for introduction after 1965.

An intensive modernization program for geological-exploratory rigs also is under way. Here the need for improvement is more pressing than in the case of development rigs, for the exploration rigs operate in less accessible regions and must drill to lower average depths. A program of geological-exploratory rig manufacture and development has been adopted for the current Seven Year Plan, the magnitude of which is indicated by the following table: [49/]

SERIES DESIGNATION	DESIGN DEPTH (Meters)	NUMBER OF RIGS MANUFACTURED PER YEAR 1959	1960	1965 Plan
YRB-1	30-50	25	40	200
YRB-2	100-250	250	335	400
YRB-3	500-600	503	355	600
YRB-4	Up to 1,200	100	110	250
YRB-5	1,800-2,000	2	5	150
YRB-7	4,500	5	5	350
TOTAL		885	850	1,950

Although only one-fourth of the exploration rigs to be manufactured in 1965 are designed for depths greater than 1,800 meters, the percentage of such rigs is increasing, showing an expectation of gradually deeper drilling. Of the above-listed rigs, only the YRB-5 and YRB-7 are deep-drilling exploratory rigs. The others are essentially for core-drilling.

Until now, the Soviet turbodrill has been the one tool significantly helpful in the rapid development of the oil fields of the Urals-Volga and of the USSR as a whole. This tool has served most admirably the needs of the oil industry and it is doubtful that, lacking the turbodrill, the USSR could have achieved the rapid rates of growth in production which have been characteristic since 1946.

But the Soviet Union is entering a new phase in its search for additional crude oil and natural gas. In this phase, which calls for the penetration of the earth's crust to average depths of 3,000 to 4,000 meters and even greater, the performance of the turbodrill so far has been wholly unsatisfactory.

It is apparent that the maximum depth for practical operation of the turbodrill is about 2,000 meters, and is about 5,000 meters under any conditions. It has also become apparent to those in the Soviet drilling industry that the use of the turbodrill in the Soviet Union may have reached its limit. 50/ As a consequence, drillers in the field have called for the almost exclusive use of rotary drilling in the deep-drilling program, but in so doing have encountered opposition at the Gosplan level, where use of the turbodrill is still advocated.

In use of the turbodrill at depths below 2,000 meters, the drop in drilling rates has been described as catastrophic. 51/ In this, the poor performance of the turbodrill itself is not completely to blame; some of the decline in drilling speeds may be attributed to the relatively poor quality of drilling bits and of pumps being produced in the Soviet Union. Increases in the depths of drilling serve to reduce the life of the bit, which is quite low even at normal depths. Thus, the necessity of more frequent bit changes, as average depths increase, results in drastically reduced drilling rates. Selected indices of deep drilling in the USSR in 1959 and 1960 are presented in Table 3-15.

TABLE 3-15

DEEP DRILLING IN THE USSR* a/ - 1959-60

ITEM	1959	1960
Average Depth (Meters)	3,880.0	4,010.0
Number of Wells Drilled	34.0	48.0
Meters Per Bit	20.4	24.3
Drilling Rate (Meters/Rig-Month)	308.0	334.0

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* Data on deep drilling for Azerbaydzhan, Stavropol'kray, Chechen-Ingush ASSR and Krasnodar kray.

a/ 52/

Soviet engineers claim that depths of up to 7,000 meters could be reached with existing drilling equipment (using the rotary drill) if the pipe-manufacturing industry could produce a good quality thin-wall drill pipe having a yield point of about 110 kilograms per square millimeter. In 1956, the deepest well in the USSR, located at the Zyrya gas-condensate deposit near Baku, was 4,812 meters. By 1961, the deepest well in the USSR, also at Zyrya, was reported at 5,020 meters, only a 288-meter gain compared with 1956. It has been reported that a "veto" exists on the drilling of wells to depths in excess of 4,000 meters because of the potential failure of the drilling column at this point. One group of Soviet experts feels that even if the USSR possessed the best bits in the world, the step to the exploitation of deep-lying strata could not be taken simply because the weight of the column would cause the drill pipe to fail.

If the deep-drilling program is to be successfully carried out, the oil industry must be provided with the following:

(a) Good quality drill pipe and tool joints;

(b) A small-diameter bit, of greater life than what is currently available;

(c) A smaller-diameter turbodrill capable of reaching the required depths.

The industry cannot afford to wait for the development and manufacture of this equipment and material. In the meantime, a combination of turbo and rotary drilling of wells will be carried out, and wells will of necessity be of large diameter--10 to 11 inches--because the existing smaller-diameter turbodrills cannot reach the desired depths.

If deeper drilling leads to the increased use of combination rotary-turbodrill techniques, as seems very possible, a new series of problems will be created. Of these, probably the most important is the development of rotary drilling know-how and the training of drilling crews in rotary practice. Other problems are related to the development of mud drilling technology, the production of drilling muds and drilling mud additives, the production of better quality drill pipe and tool joints for trouble-free rotary drilling, and the manufacture of bits capable of carrying high loadings in rotary drilling. On the other hand, a heavy commitment to the turbodrill technique, augmented by much publicity, is apt to slow down efforts to change from turbodrill to rotary drilling below 2,000 meters. Continued reliance on the turbodrill and electrodrill techniques, with the inherent lower efficiencies, would require the operation of a greater number of rigs to meet drilling volume targets.

In any event, it may be safely predicted that there will be ever increasing pressures on Soviet oil industry to seek technology and equipment in Free World markets.

D. <u>Costs</u>

Major problems confronting the Soviet oil industry with respect to drilling bits, drill pipe, inhibiting effect of increased drilling depths and the resultant general effect of reduced drilling speeds have been discussed above. The influence of these problem areas is particularly evident in an examination of average costs in the exploratory and development drilling programs. The data presented in Table 3-16 indicate that the costs reported by the USSR for exploratory drilling in 1960 increased about 6 percent compared with the 1959 level, to 114.7 rubles per meter. The 1960 exploratory drilling costs were the highest since 1955 and as such would indicate little probability on the part of the Soviet drillers of meeting the 1965 planned cost of 83.3 rubles per meter.

TABLE 3-16

COSTS OF DRILLING IN THE USSR
1955-60 AND 1965 PLAN a/
(Rubles Per Meter)

YEAR	EXPLORATORY DRILLING	DEVELOPMENT DRILLING
1955	127.0	50.2
1956	108.7	45.6
1957	112.2	49.4
1958	110.0	48.6
1959	108.3	49.4
1960	114.7	51.3
1965 Plan b/	83.3	37.5

a/ Except where noted, from 53/.
b/ 54/

Similar effects are evident in development drilling. The 1960 cost per meter of development drilling represented about a 4 percent increase over the 1959 cost per meter, reaching to 51.3 rubles per meter, for the highest average cost in the past six years. As has been indicated for exploratory costs, there seems little likelihood that the 1965 planned cost for development drilling can be achieved.

E. Requirements for Drill Pipe and Casing

The requirements of steel for use as drill pipe and as casing in the USSR during 1959-65 are to exceed 3.8 million tons. In addition, the requirements for steel pipe for pumps and compressors probably will increase this requirement to about 6.3 million tons. 55/ The consumption of drill pipe and casing in the first three years of the Seven Year Plan has accounted for about 31 percent of total requirements estimated for the period 1959-65, as shown in Table 3-17.

TABLE 3-17

ESTIMATED REQUIREMENTS FOR STEEL PIPE
IN SOVIET DRILLING OPERATIONS
1959-61 AND 1959-65 TOTAL
(Million Metric Tons)

ITEM	1959	1960	1961	1959-65
Drill Pipe a/	0.057	0.062	0.070	0.640
Casing b/	0.300	0.324	0.360	3.200
TOTAL	0.357	0.386	0.340	3.840

a/ 56/
b/ 57/

On January 1, 1960, the industry (RSFSR only) had an inventory of drill pipe in the amount of 2,432,438 meters, with a size distribution as follows: 58/

SIZE (INCHES)	PERCENT OF TOTAL	METERS	METRIC TONS
6	16.5	401,352	16,400
5	55.8	1,357,300	39,200
4	14.1	342,974	7,300
3	7.9	192,163	3,800
2	5.7	138,649	2,300
TOTAL	100.0	2,432,438	69,000

The RSFSR requirement for drill pipe in 1961 was about 43,200 tons. Comparison of this requirement with the inventory given above would indicate an annual replacement of about two-thirds of the inventory.

Just two years prior, in 1958, 36.8 percent of the warehouse stock of drill pipe was of 6-inch diameter, which would seem to indicate that considerable progress is being made in the shift toward the drilling of smaller diameter holes.

Of the quantity of drill pipe on hand on January 1, 1960, it was estimated that 34.6 percent was first class drill pipe, 28.3 percent was second class and the remainder third and fourth class.

That there is an apparent shortage of oil field tubular goods is quite clear in the efforts being made to reduce steel requirements in the oil industry. These efforts include the use of reinforced concrete in the construction of storage tanks, the use of small diameter casing, the adaptation of slim hole techniques, the use of asbestos-cement pipe in field gathering lines and in gas distribution systems, and the revision of standards of thicknesses of oil field tubular goods.

SECTION 9

PRODUCTION OF PETROLEUM

A. Crude Oil

1. Historical and Planned

The production of crude oil in the USSR during 1950-61 and that planned for 1962 and 1965 is given in Table 3-18. Of all of the major forms of primary energy in the Soviet Union, only the production of crude oil has been in excess of the annual goal for each of the first three years of the Seven Year Plan, as illustrated in the following and graphically in Figure No. 3: 4/

	(MILLIONS OF METRIC TONS)		
	1959	1960	1961
Plan	128.0	144.3*	161.0**
Actual	129.6	147.9	166.0

Cumulative above-plan production of crude oil so far during the Seven Year Plan has totalled 10.2 million tons.

Because of these early successes, the official goal for production of crude oil in 1965 now stands at 240 million tons, an upward revision from the level of 230-240 million tons established by the Seven Year Plan.

The major portion of the growth in production of crude oil in the postwar period can be attributed to continued development of new producing capacity in the Urals-Volga, to the extent that the Urals-Volga share of national output in 1960--73 percent--very nearly approximated that which had been planned

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* The Sixth Five Year Plan, (1956-60), abolished in 1958, had established 135 million tons as the crude oil production goal for 1960.

** The level called for by the Seven Year Plan. As a result of exceeding plan in 1959 and 1960, the 1961 goal subsequently was revised upward to 164 million tons.

TABLE 3-18

PRODUCTION OF CRUDE OIL IN THE USSR
1950-1961 AND PLANS FOR 1962 AND 1965 a/
(Million Metric Tons)

YEAR	AMOUNT	ANNUAL PRODUCTION INCREMENT
1950	37.878	-
1951	42.253	4.375
1952	47.311	5.058
1953	52.777	5.466
1954	59.281	6.504
1955	70.793	11.512
1956	83.806	13.013
1957	98.346	14.540
1958	113.216	14.870
1959	129.557	16.341
1960	147.864	18.307
1961 b/	166.000	18.136
1962 Plan c/	185.000	19.000
1965 Plan	240.000	-
1965 Committee Estimate	265.000	-

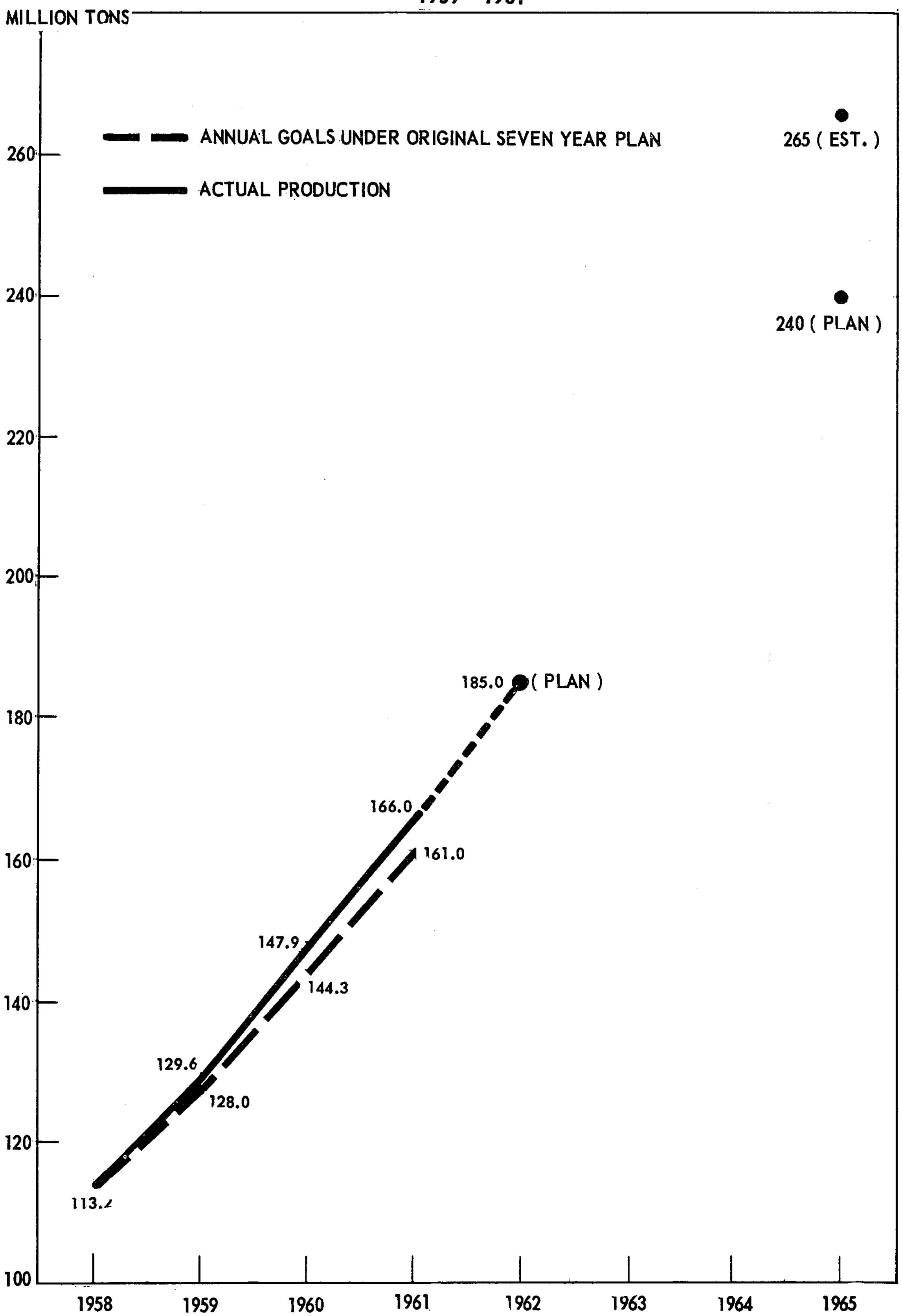
a/ Except where noted, from 1/.
b/ 2/
c/ 3/

Figure No. 3

CRUDE OIL PRODUCTION AND GOALS

IN FIRST THREE YEARS OF SEVEN YEAR PLAN

1959 - 1961



for 1965--74 percent. (See Table 3-19) The production in the next most important area--Azerbaydzhan--has been relatively constant (See Table 3-20) with the result that its share of the national output has declined. The output planned for Azerbaydzhan in 1965, if achieved, will no more than equal the output obtained in 1940. There have been no significant changes in production in other areas of the country and generally it can be said that the extraction of crude oil in areas other than the Urals-Volga is proceeding according to directives laid down by the Seven Year Plan. Locations of the major oil producing fields are shown on Map No. 3.

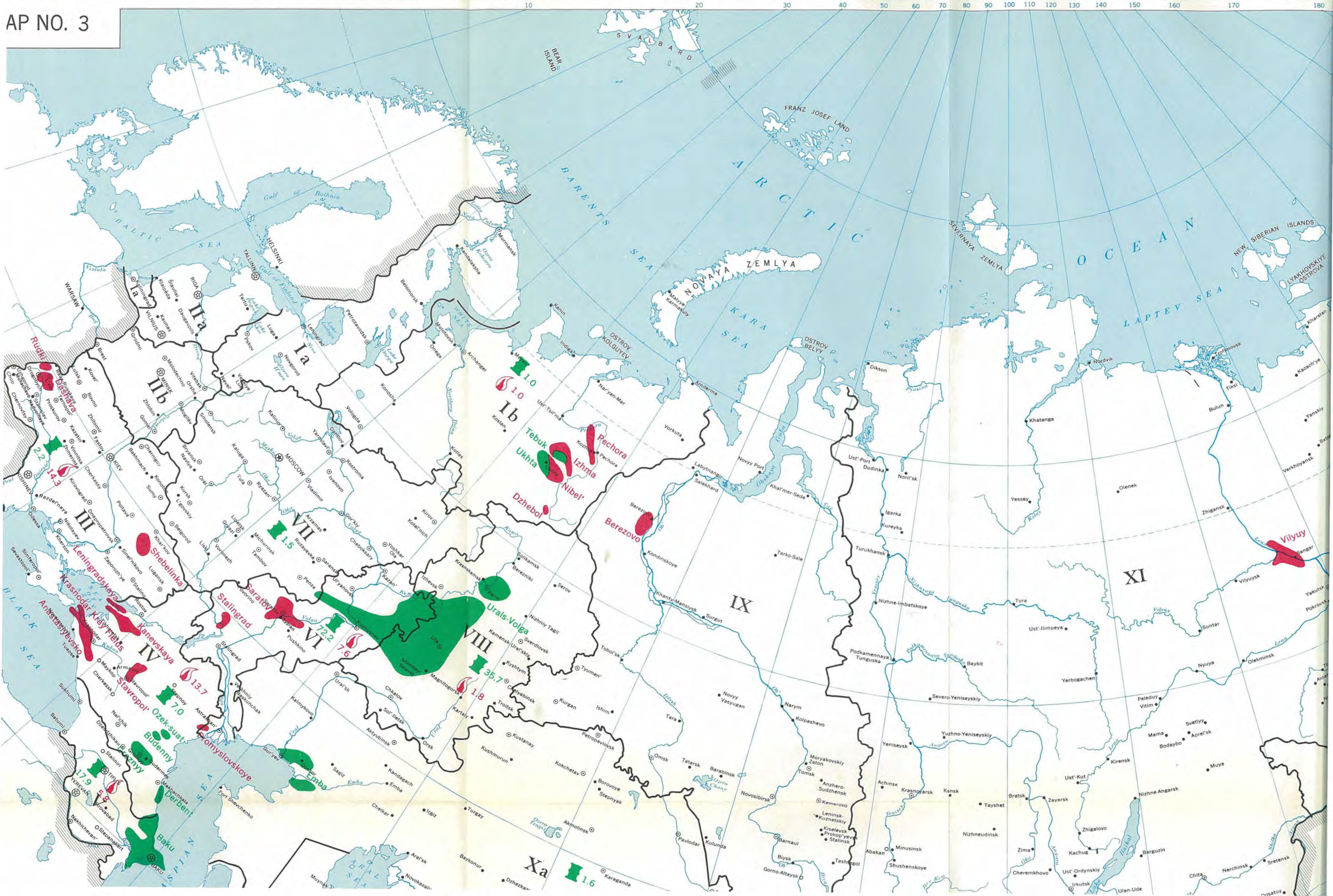
TABLE 3-19

PRODUCTION OF CRUDE OIL
IN THE URALS-VOLGA
SELECTED YEARS 1940-65

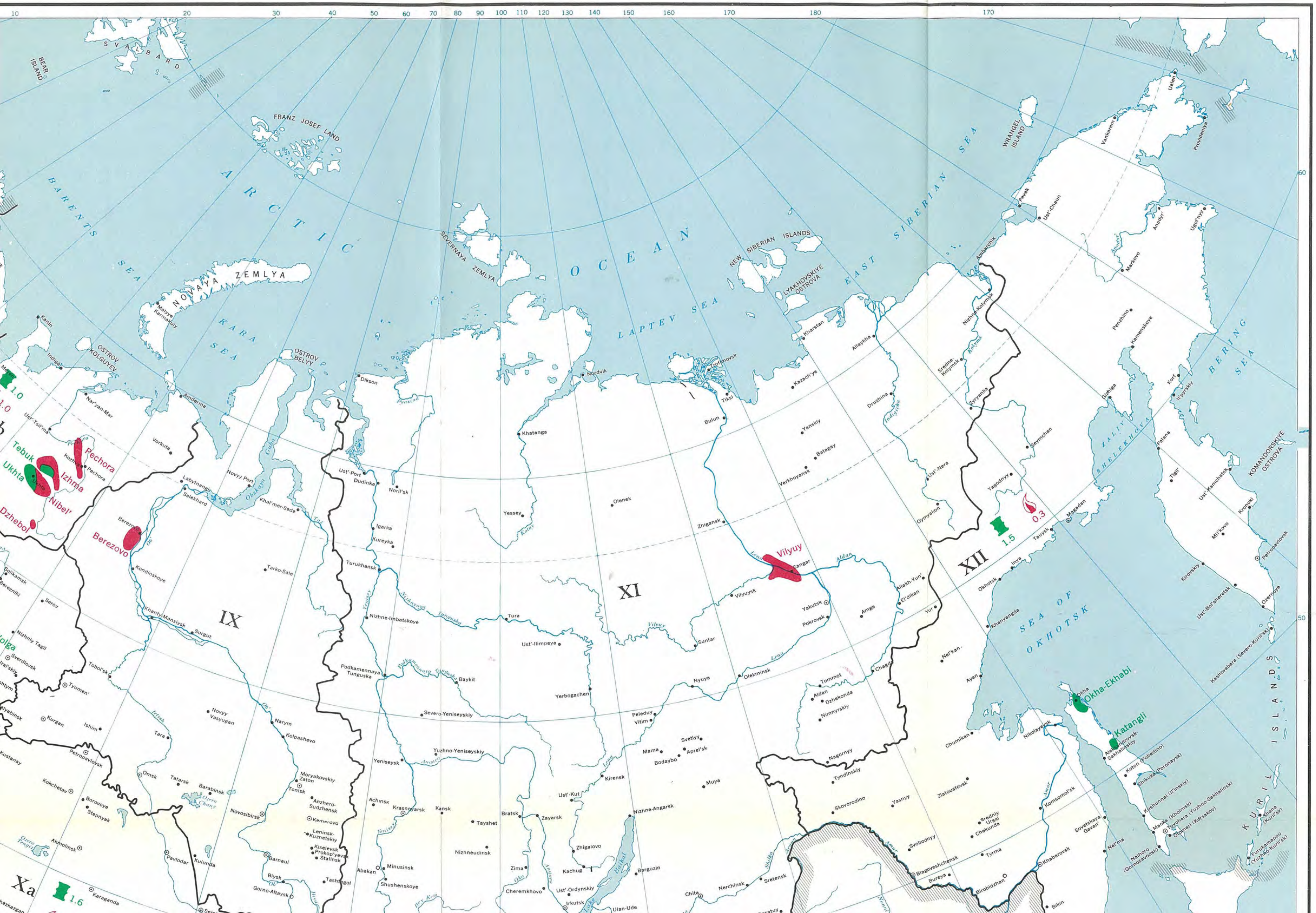
YEAR	AMOUNT (MILLION METRIC TONS)	PERCENT OF NATIONAL OUTPUT
1940	1.837	5.9 a/
1945	2.833	14.6 b/
1950	10.985	29.0 c/
1955	41.060	58.0 d/
1956	52.546	62.7 e/
1957	64.908	66.0 f/
1958	NA	NA
1959	NA	NA
1960	107.941	73.0 d/
Sixth Five Year Plan	95.900	70.0 g/
1965 Plan	177.600	74.0 e/

a/ 5/
b/ 6/
c/ 7/
d/ 8/
e/ 9/
f/ 10/
g/ 11/

AP NO. 3



10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
BEAR ISLAND
S V A L B A R D
FRANZ JOSEF LAND
A R C T I C
O C E A N
B A R E N T S
S E A
NOVAYA ZEMLYA
K A R A
S E A
SEVERNAYA ZEMLYA
NEW SIBERIAN ISLANDS
LYAKHOVSKIYE OSTROVA
LAPTEV SEA
OSTROV KOLGUYEV
OSTROV BELYY
B A L T I C
S E A
Gulf of Bothnia
Gulf of Finland
WHITE SEA
BLACK SEA
CASPIAN SEA
ARAL SEA
HELSINKI
TALLINN
RIGA
VILNIUS
MINSK
WARSAW
KIEV
MOSCOW
KISHINEV
Murmansk
Kandalaksha
Belomorsk
Petrozavodsk
Archangel
Onega
Leningrad
Novgorod
Pskov
Tartu
Daugavpils
Kaunas
Grodno
Brest
Kovel'
Rovno
Zhitomir
Fastov
Vinnitsa
Kazatin
Proskurov
Ternopol'
Chernovtsy
Stanislav
Drogobych
Mozyr'
Gomel'
Zhlobin
Mogilev
Orsha
Vitebsk
Smolensk
Bryansk
Navlya
Orel
Kursk
L'govskiy
Kaluga
Tula
Ryazan'
Belgorod
Lipetsk
Gryazi
Voronezh
Liski
Michurinsk
Tambov
Kalinin
Yaroslavl'
Vologda
Kostroma
Ivanovo
Vladimir
Gor'kiy
Arzamas
Kirov
Kotel'nich
Kotlas
Konosha
Mezen'
Kanin
Indiga
Nar'yan-Mar
Ust'-Tsil'ma
Kosjan
Amderma
Vorkuta
Pechora
Ukhta
Tebuk
Izhma
Nibel'
Dzhebol
Berezovo
Labytnangi
Salekhard
Novyy Port
Khal'mer-Sede
Kondinskoye
Khanty-Mansiysk
Surgut
Tobol'sk
Tyumen'
Kurgan
Ishim
Tara
Omsk
Tatarsk
Barabinsk
Novosibirsk
Kolpashevo
Narym
Tomsk
Moryakovskiy Zaton
Anzhero-Sudzhensk
Kemerovo
Leninsk-Kuznetskiy
Kiselevsk
Prokop'yevsk
Stalinsk
Barnaul
Biysk
Gorno-Altaysk
Pavlodar
Kulunda
Novyy Vasyugan
Tarko-Sale
Dikson
Ust'-Port
Dudinka
Noril'sk
Igarka
Kureyka
Turukhansk
Nizhne-Imbatskoye
Tura
Ust'-Ilimpeya
Podkamennaya Tunguska
Baykit
Severo-Yeniseyskiy
Yuzhno-Yeniseyskiy
Yeniseysk
Achinsk
Krasnoyarsk
Kansk
Tayshet
Nizhneudinsk
Abakan
Minusinsk
Shushenskoye
Bratsk
Zayarsk
Zima
Cheremkhovo
Ust'-Ordynskiy
Irkutsk
Ulan-Ude
Ust'-Kut
Kirensk
Nizhne-Angarsk
Zhigalovo
Kachug
Barguzin
Chita
Nerchinsk
Sretensk
Yerbogachen
Peleduy
Vitim
Mama
Bodaybo
Svetlyy
Aprel'sk
Muya
Nyuya
Olekminsk
Suntar
Vilyuysk
Yakutsk
Pokrovsk
Sangar
Vilyuy
Zhigansk
Olenek
Yessey
Khatanga
Nordvik
Tiksi
Bulun
Verkhoyansk
Kazach'ye
Yanskiy
Kharstan
Stolbovaya
Solikamsk
Berezniki
Krasnokamsk
Perm'
Izhevsk
Serov
Nizhniy Tagil
Kamensk Ural'skiy
Sverdlovsk
Kyshtym
Chelyabinsk
Troitsk
Magnitogorsk
Kartaly
Ufa
Ishimbay
Salavat
Kuybyshev
Syzran'
Ul'yanovsk
Kazan'
Cheboksary
Yoshkar Ola
Saransk
Ruzayevka
Penza
Saratov
Stalingrad
Pushkino
Chkalov
Sol'-Iletsk
Aktyubinsk
Orsk
Ural'sk
Kustanay
Petropavlovsk
Kokchetav
Borovoye
Stepnyak
Akmolinsk
Karaganda
Dzhezkazgan
Kushmurun
Turgay
Irgiz
Chelkar
Aral'sk
Novokazalinsk
Baykonur
Kandagach
Emba
Sagiz
Gur'yev
Astrakhan'
Kalmykovo
Verkhniy Baskunchak
Kharkov
Poltava
Sumy
Konotop
Chernigov
Bakhmach
Cherkassy
Kremenchug
Kirovograd
Dnepropetrovsk
Zaporozh'ye
Sinel'nikovo
Lugansk
Stalino
Rostov
Nikolayev
Kherson
Odessa
Razdel'naya
Simferopol'
Sevastopol'
Krasnodar
Tuapse
Maykop
Armavir
Cherkessk
Nal'chik
Stavropol'
Groznyy
Makhachkala
Derbent
Sukhumi
Batumi
Dzaudzhikau
Staliniri
TBILISI
YEREVAN
Kirovabad
Stepanakert
Nakhichevan'
BAKU
Fort Shevchenko
Rudki
Dashava
Shebelinka
Leningradskaya
Krasnodar Kray fields
Anastasiyevsko
Kanevskaya
Stavropol'
Ozek-suat
Budenny
Groznyy
Promyslovskoye
Derbent
Baku
Emba
Urals-Volga
Vilyuy
Ia
Ib
IIa
IIb
III
IV
V
VI
VII
VIII
IX
Xa
XI
1.0
1.0
2.2
14.3
1.5
72.2
7.6
35.7
1.8
13.7
7.0
17.9
5.4
1.6



BEAR ISLAND
SVALBARD
FRANZ JOSEF LAND
BARENTS SEA
ARCTIC OCEAN
NOVAYA ZEMLYA
KARA SEA
SEVERNAYA ZEMLYA
LAPTEV SEA
NEW SIBERIAN ISLANDS
LYAKHOVSKIYE OSTROVA
EAST SIBERIAN SEA
WRANGEL ISLAND
BERING SEA
SEA OF OKHOTSK
KURIL ISLANDS
KOMANDORSKIYE OSTROVA
OSTROV KOLGUYEV
OSTROV BELYY
ZALIV SHELEKHOVA
IX
XI
XII
Xa
1.0
1.0
1.5
0.3
1.6
Tebuk
Ukhta
Pechora
Izhma
Nibel'
Dzhebol
Berezovo
Vilyuy
Okha-Ekhabi
Katangli
Kanin
Indiga
Nar'yan-Mar
Ust'-Tsil'ma
Vorkuta
Amderma
Labytnangi
Salekhard
Novyy Port
Khal'mer-Sede
Dikson
Ust'-Port
Dudinka
Noril'sk
Igarka
Kureyka
Turukhansk
Khatanga
Nordvik
Yessey
Olenek
Tiksi
Bulun
Zhigansk
Sangar
Vilyuysk
Yakutsk
Pokrovsk
Suntar
Tura
Nizhne-Imbatskoye
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Tarko-Sale
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Surgut
Serov
Tobol'sk
Tyumen'
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Novyy Vasyugan
Narym
Kolpashevo
Omsk
Tatarsk
Barabinsk
Novosibirsk
Tomsk
Kemerovo
Barnaul
Biysk
Gorno-Altaysk
Pavlodar
Kulunda
Petropavlovsk
Kokchetav
Akmolinsk
Karaganda
Yeniseysk
Achinsk
Krasnoyarsk
Kansk
Tayshet
Bratsk
Zayarsk
Ust'-Kut
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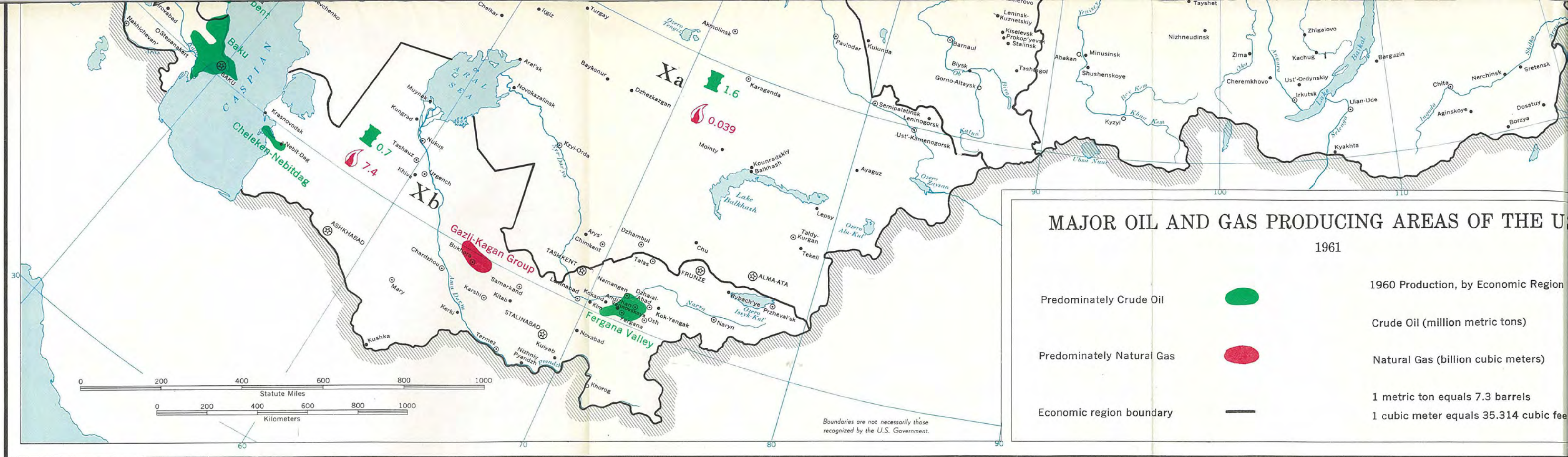
Zhigalovo
Kachug
Irkutsk
Ulan-Ude
Barguzin
Cheremkhovo
Zima
Nizhneudinsk
Abakan
Minusinsk
Shushenskoye
Bodaybo
Mama
Muya
Chita
Nerchinsk
Sretensk
Olekminsk
Nyuya
Tommot
Aldan
Nimnyrskiy
Nagornyy
Tyndinskiy
Skovorodino
Yasnyy
Zlatoustovsk
Svobodnyy
Blagoveshchensk
Bureya
Birobidzhan
Khabarovsk
Komsomol'sk
Nikolayevsk
Chumikan
Ayan
Nel'kan
Okhotsk
Inya
Tauysk
Magadan
Yagodnyy
Seymchan
Oymyakon
Ust'-Nera
Zyryanka
Sredne-Kolymsk
Nizhne-Kolymsk
Ambarchik
Pevek
Ust'-Chaun
Markovo
Anadyr'
Ugol'nyy
Vankarem
Uelen
Provideniya
Penzhino
Kamenskoye
Gizhiga
Palana
Tigil'
Ust'-Kamchatsk
Kronoki
Mil'kovo
Petropavlovsk
Kirovskiy
Ozernoye
Ust'-Bol'sheretsk
Kashiwabara (Severo-Kuril'sk)
Okha
Aleksandrovsk-Sakhalinskiy
Koton (Pobedino)
Shikuka (Poronaysk)
Kushunnai (Il'inskiy)
Maoka (Kholmsk)
Toyohara (Yuzhno-Sakhalinsk)
Otomari (Korsakov)
Nayoro (Gornozavodsk)
Sovetskaya Gavan'
Nel'ma
Kharstan
Allaykha
Kazach'ye
Yanskiy
Batagay
Verkhoyansk
Druzhina
Amga
Allakh-Yun'
El'dikan
Yur
Khanyangda
Peleduy
Vitim
Svetlyy
Aprel'sk
Dzhekonda
Chagda


MAJOR OIL AND GAS PRODUCING AREAS OF THE U
1961
1960 Production, by Economic Region
Predominately Crude Oil
Crude Oil (million metric tons)
Predominately Natural Gas
Natural Gas (billion cubic meters)
1 metric ton equals 7.3 barrels
Economic region boundary
1 cubic meter equals 35.314 cubic fee
Xa
1.6
0.039
Xb
0.7
7.4
Baku
Cheleken-Nebitdag
Gazli-Kagan Group
Fergana Valley
CASPIAN
ARAL SEA
Lake Balkhash
Statute Miles
0
200
400
600
800
1000
Kilometers
0
200
400
600
800
1000
Boundaries are not necessarily those recognized by the U.S. Government.

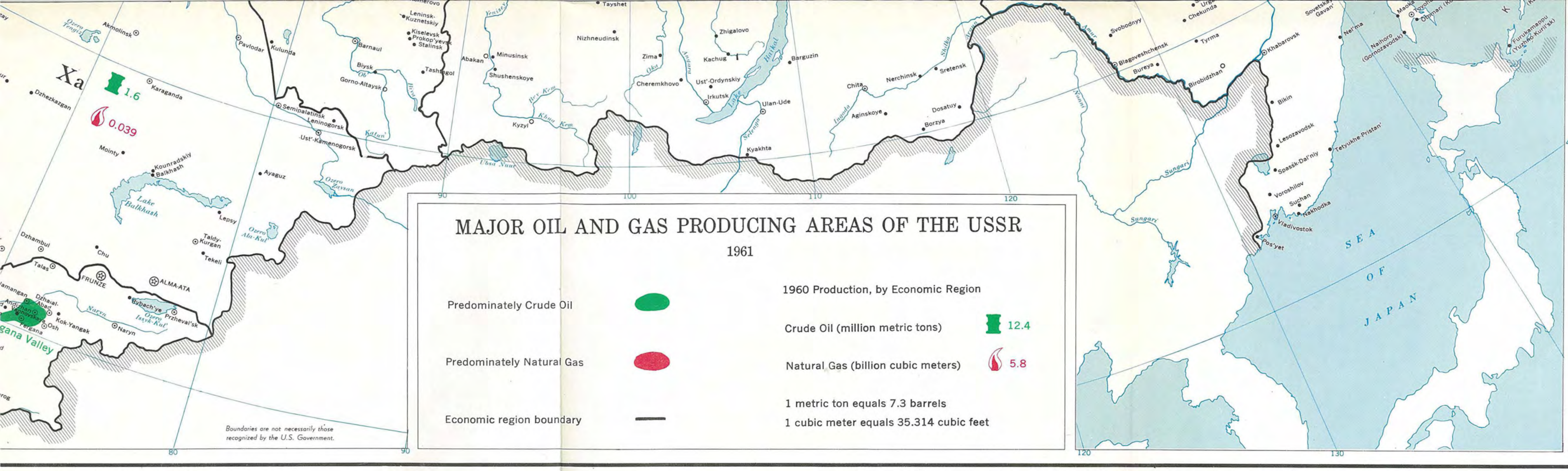

MAJOR OIL AND GAS PRODUCING AREAS OF THE USSR
1961
Predominately Crude Oil
Predominately Natural Gas
Economic region boundary
1960 Production, by Economic Region
Crude Oil (million metric tons) 12.4
Natural Gas (billion cubic meters) 5.8
1 metric ton equals 7.3 barrels
1 cubic meter equals 35.314 cubic feet
Boundaries are not necessarily those recognized by the U.S. Government.
SEA OF JAPAN
Fergana Valley
1.6
0.039

TABLE 3-20

DECLINE IN IMPORTANCE OF PRODUCTION OF CRUDE OIL FROM AZERBAYDZHAN SELECTED YEARS 1940-65

YEAR	PRODUCTION (MILLION METRIC TONS)	PRODUCTION (AS PERCENT OF NATIONAL TOTAL)
1940 a/	22.231	71.4
1945 b/	11.541	59.4
1950 c/	14.822	39.1
1955 a/	15.305	21.6
1956 c/	15.586	18.6
1957 c/	15.977	16.2
1958 a/	16.497	14.6
1959 a/	17.076	13.2
1960 a/	17.867	12.1
1961 d/	18.700	11.3
1965 Plan e/	22.000	9.2 f/
1965 Estimate	23.000 g/	8.7 f/

a/ 12/
b/ 13/
c/ 14/
d/ 15/
e/ 16/
f/ As related to planned national output.
g/ 17/

Table 3-21 presents the production of crude oil in the USSR, by republic, in 1958 and 1961. More meaningful, however, is the estimated regional production of crude oil in 1960, given in Table 3-22 and Map No. 3. This distribution clearly illustrates that, exclusive of the Urals-Volga and the Trans-caucasus (primarily Azerbaydzhan), production in other areas of the USSR is of little significance.

The Committee believes that the production of crude oil in the USSR in 1965 will be well in excess of the plan of 240 million tons and may reach to as much as 265 million tons. Much of the probability of achieving a production level of 265 million tons by 1965 depends upon the desire of the responsible Soviet authorities to move forward with the petroleum program and the

TABLE 3-21

PRODUCTION OF CRUDE OIL
IN THE USSR, BY REPUBLIC a/
1958 AND 1961

REPUBLIC	1958 AMOUNT (MILLION METRIC TONS)	1958 PERCENT OF TOTAL	1961 AMOUNT (MILLION METRIC TONS)	1961 PERCENT OF TOTAL
RSFSR	87.978 b/	77.7	134.500	81.0
Ukraine	1.236	1.1	2.837	1.7
Uzbek	1.297	1.1	1.705	1.0
Kazakhstan	1.511	1.3	1.700	1.0
Georgia	0.035 b/	negl.	0.034 c/	negl.
Azerbaydzhan	16.497 b/	14.6	18.700	11.3
Kirgiz	0.490	0.4	0.422	0.3
Tadzhik	0.018	negl.	0.015	negl.
Turkmen	4.154	3.8	6.110	3.7
TOTAL	113.216	100.0	166.023	100.0

a/ Except where noted, from 18/.
b/ 19/
c/ Estimate.

TABLE 3-22

ESTIMATED REGIONAL PRODUCTION
OF CRUDE OIL IN THE USSR - 1960

ECONOMIC REGION	DESIGNATION	AMOUNT (MILLION METRIC TONS)	PERCENT OF TOTAL
Soviet North	I	1.000	0.7
South	III	2.159	1.6
North Caucasus	IV	7.000	4.7
Transcaucasus	V	17.867	12.1
Volga	VI	72.200	48.8
Center	VII	1.500	1.0
Urals	VIII	35.700	24.1
Kazakhstan	Xa	1.610	1.0
Central Asia	Xb	7.364	5.0
Far East	XII	1.500	1.0
TOTAL		147.900	100.0

assistance the USSR is able to secure from the Free World in the supply of critical materials and equipment. Whether the USSR will produce as much as 265 million tons of crude oil in 1965 undoubtedly will depend on the value they place on petroleum exports for political purposes as well as a medium for obtaining Western technology and equipment.

2. Methods of Production and Means for Increases

The most widely used artificial means of maintaining and increasing production of crude oil in the USSR is the pressure maintenance technique of water injection. Use of water injection has been very successful in the USSR and it is reported that about 66 percent of the total crude production is provided by formations subjected to water injection. By 1965, 81 percent of total annual production is to be provided by water flooding. 20/

Other means, such as hydraulic fracturing of strata and acidizing have found only minimal use and make no significant contribution to the annual yield of crude oil.

The annual volume of water injection and the number of hydraulic fracturing operations for 1950, 1955-60 and 1965 Plan is given in Table 3-23.

The expanding use of water flooding in the USSR has served to raise the amount of crude oil extracted from free-flowing wells from 32.5 percent of the total in 1950 to 73.7 percent in 1960, as illustrated in Table 3-24. At the same time, average well productivity has been greatly increased.

The number of producing oil wells in the Soviet Union has increased from 21,500 in 1950 25/ to slightly more than 34,400 in 1961, 26/ as average well productivity has grown from 1,968 tons per year (about 39.4 barrels per day) in 1950 to 4,820 tons per year in 1961 (96.4 barrels per day).

3. Costs of Production

It should be noted that because of the peculiarities of the applied Soviet accounting system with respect to calculation of the cost of production of crude oil (and associated natural gas), certain major areas of expenditure have been eliminated. These areas include expenditures incurred in prospecting and in exploratory drilling. Only if an exploratory effort yields crude oil or gas is the cost of exploratory

TABLE 3-23

PROGRAM OF WATER INJECTION AND HYDRAULIC FRACTURING IN THE USSR 1950, 1955-60, AND 1965 PLAN

YEAR	WATER INJECTION (MILLION CUBIC METERS)	HYDRAULIC FRACTURING (NUMBER OF OPERATIONS)
1950 a/	8.9	-
1955 a/	81.6	878
1956 b/	107.3	1,901
1957 b/	116.0	2,905
1958 a/	141.6	2,713
1959 a/	164.7	2,262
1960 a/	189.4	2,707
1965 Plan c/	310.2	NA

a/ 21/
b/ 22/
c/ 23/

TABLE 3-24

METHODS OF PRODUCTION OF CRUDE OIL IN THE USSR a/ - 1950 AND 1955-60 (Percent of Total)

YEAR	FREE-FLOWING	PUMP	COMPRESSOR b/	OTHER	TOTAL
1950	32.5	44.7	21.1	1.7	100
1955	58.3	34.0	6.5	1.2	100
1956	64.5	29.6	5.0	0.9	100
1957	69.0	26.5	3.9	0.6	100
1958	70.4	25.6	3.4	0.6	100
1959	72.7	24.2	2.6	0.5	100
1960	73.7	23.5	2.3	0.5	100

a/ 24/
b/ Gas or air-lift.

drilling taken into account, and then only at the cost of drilling a comparable development well. Authoritative Soviet sources indicate that inclusion of the prospecting and exploratory drilling costs would serve to raise the actual cost of production per ton by 30 to 40 percent above those quoted in this section.27/

However, this arbitrary method of ignoring prospecting and exploratory costs should simplify the problem of allocation of costs between oil and gas to a considerable extent. In this respect it is quite different than the problem encountered in the U.S. in such allocation.

While the Committee recognizes the shortcomings in these reported figures, they are significant from a trend standpoint and also because they represent what the Soviet planners are willing to consider as their costs.

The USSR has reported a significant reduction in production costs in the 10-year period 1950-60, from 5.9 rubles per metric ton (the equivalent of about 90 cents per barrel at the official exchange rate) in 1950 to 3.2 rubles (less than 49 cents per barrel) in 1960. A further decline, to 2.7 rubles per ton, has been planned for 1965. Table 3-25 presents reported and planned costs of production of crude oil (and associated natural gas) in the USSR for 1950, 1955-60 and 1965 Plan.

TABLE 3-25

COST OF EXTRACTION* OF CRUDE OIL AND ASSOCIATED NATURAL GAS IN THE USSR 1950, 1955-60 AND 1965 PLAN

YEAR	RUBLES PER METRIC TON**	YEAR	RUBLES PER METRIC TON**
1950	5.9 a/	1958	3.5 b/
1955	4.6 b/	1959	N.A.
1956	4.1 c/	1960	3.2 d/
1957	3.7 b/	1965 Plan	2.7 a/

* Excludes prospecting and certain exploratory drilling costs.
** Cost is based on tons of crude oil plus associated natural gas. It is estimated that there are about 0.05 tons of associated natural gas for each ton of crude oil.
a/ 28/ c/ 30/
b/ 29/ d/ 31/

The cost of production of crude oil (and associated natural gas) varies widely in the USSR with respect to location of deposits. By far the cheapest crude oil available in the USSR is that obtained from the highly prolific oil fields of the Urals-Volga. Conversely, apparently the most expensive crude is that produced on Sakhalin Island, as shown in the following tabulation: 32/

AREA OF PRODUCTION	1958 UNIT COST OF PRODUCTION AS PERCENT OF THE NATIONAL AVERAGE
Bashkir ASSR (Urals-Volga)	53.7
Tatar ASSR (Urals-Volga)	39.6
Kuybyshev Oblast (Urals-Volga)	42.1
Ukraine SSR	153.0
Turkmen SSR	165.0
Azerbaydzhan SSR	217.0
Chechen-Ingush ASSR	242.0
Sakhalin Island	331.0

Most of the decline in the national average cost of production has been possible through reductions in production costs in the Urals-Volga, which have been amplified because of the relatively high share these fields provide in the total annual output. The decline in the cost of production at the fields of the Ukraine have not been particularly significant as the volume of production is only of minor proportion. Similarly the effect of the 47 percent increase in production costs from the Chechen-Ingush fields largely has been cancelled by the declining role which can be attributed to the output from these fields. Fluctuations in the cost of production of crude oil (and associated natural gas) in the USSR by selected area of production for the years 1950-58 are given in Table 3-26.

4. Reserves

Not since the late 1930's has the Soviet Union published any definitive information on the amount of proved reserves of crude oil. Some basis for estimating Soviet proved reserves was given to the U.S. oil delegation which toured the USSR in August, 1960; and as a result of examination of the information acquired, at that time it was considered that the current proved reserves/crude oil production ratio in the Soviet Union was on the order of 22 to 1. 35/ Since then, further analysis

TABLE 3-26

FLUCTUATIONS IN THE COST OF PRODUCTION*
OF CRUDE OIL AND ASSOCIATED NATURAL GAS
IN THE USSR BY AREA OF PRODUCTION a/
1950, 1955 AND 1958
(Rubles Per Metric Ton)

AREA	1950	1955	1958 AMOUNT	1958 AS PERCENT OF 1950
Bashkir ASSR (Urals-Volga)	2.85	1.91	1.88	66.0
Tatar ASSR (Urals-Volga)	3.31	1.52	1.39	42.0
Kuybyshev Oblast (Urals-Volga)	2.92	2.23	1.47	50.3
Ukraine SSR	23.30	11.65	5.36	23.0
Turkmen SSR	5.64	7.11	5.78	102.5
Azerbaydzhan SSR	6.85	9.04	7.60	111.0
Chechen-Ingush ASSR	5.76	8.87	8.47	147.0
Sakhalin Island	15.02	14.54	11.58	77.1
Kazakhstan	11.21 b/	9.53 a/	9.42	84.0

* Excludes prospecting and certain exploratory drilling costs.
a/ 33/
b/ 34/

of the acquired data, plus additional references, has indicated that this ratio probably should be revised downward, to 20 to 1 for the period 1950-61. During the Seven Year Plan, the proved reserves of crude oil are to increase by 1.7 times. 36/ If this level is achieved, then the reserves/production ratio in 1965 (production in 1965 taken at the planned level) would be on the order of 16 to 1.

The estimates of proved reserves of crude oil in the Soviet Union, as agreed on by the Committee, reflect these two ratios and are as follows:

END OF YEAR	BILLION METRIC TONS
1950	0.758
1955	1.416
1958	2.264
1960	2.958
1961	3.320
1965 Plan	3.848

5. Projections for the Future

In the last few years the Soviet press has reported new discoveries of crude oil in Siberia and on the Mangyshlak Peninsula located on the Eastern shore of the Caspian. The oil discovery made on the Mangyshlak Peninsula is considered by the USSR to be one of the important discoveries of the 1960's. This discovery, described as a multi-billion barrel field, reportedly has some 40 pays, which are extremely porous and permeable. In addition, other discoveries have been reported at Prorva, Barankul, and Kenkiyak, to the north of the Mangyshlak Peninsula along the shore of the Caspian Sea. These finds could support the development of Western Kazakhstan as a leading oil producing area.

In October, 1961, the USSR announced plans for the development of production of crude oil for the twenty-year period 1961-80. By the close of this period, crude oil output is to reach to 690-710 million tons, 37/ with output in the intervening years to reach 390 million tons in 1970 38/ and 545 million tons in 1975. 39/ Although the Soviet oil industry has in recent years demonstrated its ability to achieve the planned levels of production, the very magnitude of the output of crude oil foreseen for 1980 is sufficient to warrant a close examination of the effort required if such a goal is to be attained.

First, it is apparent that a very substantial volume of crude oil must be found. Based on statements by Soviet authorities with reference to the current rate of depletion of oil fields in the USSR, it may be estimated that the remaining in-ground reserves in the terminal year of 1980 will be about 15 times the production or about 10.5 billion tons (using 1980 production as the mid-point of the range of 690-710 million tons). January 1, 1961, reserves have been estimated at 20 times 1960 production, or 2.96 billion tons (21.6 billion barrels). New finds, therefore, must amount to the increase in in-ground reserves of about 7.5 billion tons, plus interim production on the order of 8.3 billion tons, or about 15.8 billion tons (115.3 billion barrels). From the geological information available, the Committee concludes that there should be at least this much oil in place in the USSR. For comparison, total U.S. crude oil reserves found and developed as of January 1, 1962, were on the order of 100 billion barrels, of which 67.8 billion barrels represented cumulative production.

The 15.8 billion tons of crude oil programmed to be found during the 20-year period 1961-80 represents an impressive task when compared with oil finds since World War II. From 1946 through 1960, the USSR produced about 1 billion tons of crude oil and increased the terminal reserves by 2.57 billion tons. Thus new reserves of 3.57 billion tons were found in this period.

Discussion of the drilling program envisaged for 1961-80 has been presented elsewhere in the report. It has been stated that the total exploration drilling for crude oil and natural gas during 1961-80 will be 150-180 million meters and that gas exploration drilling alone will reach 86.5 million meters. Thus by difference an average value for crude oil exploration may be estimated as 78 million meters. Plans for crude oil development drilling have not been announced publicly, although it has been stated that a total of 150 thousand "development and related" wells would be completed. If an average well depth of 2,100 meters is assumed, then development drilling requirements would be 315 million meters.

With these assumptions, it is possible to compare the Soviet expectations of discovery/drilling ratios with past experience:

ITEM	1946-60		1961-80
Exploration Drilling (million meters)	29.40		78.00
Development Drilling (million meters)	35.40	(Est.)	315.00
TOTAL DRILLING	64.80		393.00
Cumulative Crude Oil Production (billion metric tons)	1.00		8.30
Increase in in-ground proved reserves (billion metric tons)	2.57		7.50
TOTAL NEW FINDS (billion metric tons)	3.57		15.80
Crude Oil Discovered Per Meter of Exploratory Drilling (tons per meter)	121.00		203.00
Crude Oil Discovered Per Meter of Total Drilling (tons per meter)	55.00		40.00

In the above tabulation, the apportionment between exploratory and development drilling for 1961-80 is suspect, as it indicates a substantially different ratio than the 1946-60 period. It is unlikely that the USSR should expect to find in the future 203 tons of crude oil per meter of exploratory drilling, when past data show a discovery ratio of 121 tons per meter--particularly in view of continuing reports that future fields are likely to be found at increasingly greater depths. However, the rate of 40 tons of crude oil found per meter of total drilling appears reasonable and conservative when compared with the 1946-60 experience of 55 tons per meter. It is possible that the 150 thousand wells defined as "development and related", from which the development drilling estimate is derived, include some wells of a type that in earlier statistics were considered as exploratory wells. Nevertheless, the estimate of 393 million meters of total drilling for crude oil appears consistent with an independent Soviet statement that total oil and gas drilling during the 20-year period would reach 500 million meters.

It is probable that the USSR has made realistic estimates of the drilling effort required to achieve the future production goals. Results during 1958-61 showed that production targets were exceeded although drilling plans were not met. This situation will not necessarily continue in the long-term future and the USSR apparently recognizes this fact. The achievements of the oil program today are closely related to the finding of a number of major deposits during the 1950's. The oil industry may not be so fortunate in the future.

As shown in Table 3-27, which represents the Soviet estimates of the probable regional distribution of production of crude oil in the USSR in 1980, the Urals-Volga is to continue to be the major source of production, although the share anticipated for 1980--slightly more than 50 percent--will represent a decline from the current position. Although the likelihood of finding new oil fields of major importance in the Urals-Volga has been lessened, prospects of finding a large number of medium-size and small-size fields are excellent. A large portion of the increase in production is expected to come from an extension of existing oil producing areas, primarily through deeper drilling in such areas as Baku and Groznyy, and from improvements in petroleum technology.

TABLE 3-27

SOVIET ESTIMATES OF PROBABLE REGIONAL DISTRIBUTION OF PRODUCTION OF CRUDE OIL IN THE USSR - 1980

REGION	MILLION METRIC TONS	PERCENT OF TOTAL
Urals-Volga	350	50.0 a/
West Siberia)		
East Siberia)	42	6.0 a/
Far East)		
Ukraine	42	6.0 a/
Kazakhstan	35	5.0 a/
Turkmen	28	3-4.0 a/
North Caucasus)		
Uzbek)	154	22.0 b/
Kirgiz)		
Tadzhik)		
Azerbaydzhan	49	7.0 a/
TOTAL	700 c/	100.0

a/ 40/
b/ By difference.
c/ Mid point of 690-710 million ton range.

In summation, it is not feasible to forecast success or failure of achieving the long range production goals. The program is extremely ambitious, but the goals appear consistent with announced plans for prospecting and drilling and are not unreasonable in view of the probable oil reserves of the USSR. Technical manpower should be adequate to meet the requirements. Probably the greatest hazard in the 1961-80 plans can be found in the deficiencies present in drilling and producing equipment and technology, in the shortage of drill pipe, casing and line pipe, in engines and compressors, and in material and supplies related to drilling and producing operations. These include drilling muds, cement, chemicals and construction materials for roads, camps and other facilities. In an attempt to overcome these problems, it can be expected that the Soviet Union will look increasingly to the Free World for the supply of equipment and technology.

B. Natural Gas

1. Actual and Planned Production

The reported gross production of natural gas in the USSR for 1940 through 1961 and planned production for 1962 and 1965 are shown on Table 3-28.

Although the production of natural gas in the USSR during the six year period 1956-1961 increased by almost 6.6 times, to 59 billion cubic meters, the annual performance of the industry during these years has been a source of disappointment to Soviet planners. Largely because of continued lags in the installation of compressors on existing gas pipelines, the failure to ready potential consumers for the use of natural gas, and the lack of underground storage facilities required to meet peak load demands, the natural gas industry has not been able to meet a single annual goal for production since 1956.

No information is available which would indicate what level of production of natural gas had been planned for 1956, but an analysis of other data indicates that the reported production of gas in that year--12.069 billion cubic meters--probably was adequate to meet the plan. Planned production increases in natural gas for 1957 and 1958 were based for the most part on increased pipeline transmission capacity made available through completion of the 1,300 kilometer Stavropol'-Moscow gas pipeline. Although this pipeline was completed on schedule, the failure to install any compressors on the line greatly reduced its carrying capacity. As a result, neither the 1957 nor the 1958 goals for production of natural gas were

TABLE 3-28

GROSS PRODUCTION OF NATURAL GAS IN THE USSR a/
1940-61, 1962 AND 1965 PLANS

YEAR	AMOUNT (MILLION CUBIC METERS)
1940	3,219.1
1941	3,461.3
1942	2,045.3
1943	1,852.2
1944	2,405.3
1945	3,277.8
1946	3,902.4
1947	4,829.8
1948	5,219.3
1949	5,395.6
1950	5,760.0
1951	6,251.0
1952	6,382.8
1953	6,866.4
1954	7,510.1
1955	8,979.0
1956	12,069.0
1957	18,583.1
1958	28,084.6 b/
1959	35,391.0 b/
1960	45,303.2 b/
1961	59,000.0 c/
1962 Plan	70,500.0 d/
1965 Plan	148,280.0
1965 Committee Estimate	135,000.0

a/ Except where noted, from 41/ (includes both associated and non-associated natural gas).
b/ 42/
c/ 43/
d/ 44/

met. As shown in Table 3-29, actual production in 1957 was more than 10 percent below plan and the 1958 production was more than 6 percent below plan.

TABLE 3-29

NATURAL GAS PRODUCTION FAILURES IN THE USSR DURING THE SIXTH FIVE YEAR PLAN* (1956-58) (Billion Cubic Meters)

YEAR	PLAN	REPORTED a/	SHORTAGE	PERCENTAGE FULFILLMENT OF ANNUAL PLAN
1956	12.1	12.1	-	100.0
1957	20.8 b/	18.6	2.2	89.4
1958	30.0 c/	28.1	1.9	93.7
TOTAL 1956-58	62.9	58.8	4.1	93.5

* Abolished in 1958.
a/ Data from Table 3-28.
b/ 45/
c/ 46/

The original directives of the Sixth Five Year Plan (1956-1960) called for the total production of gas in 1960 to reach to 40 billion cubic meters, of which 36.5 billion cubic meters would be natural gas and 3.5 billion cubic meters would be gas produced from shale and the underground gasification of coal. 47/ But unexpected success in the discovery of new gas fields, particularly in Central Asia, and an upward re-evaluation of the reserves of the Stepnoye, Shebelinka, and Stavropol' gas fields, among others, brought about a number of subsequent revisions of the production goal for 1960. As this goal was raised, so were the annual goals leading to it. An examination of available Soviet literature indicates that the goal for 1960 apparently was revised a total of three times, each revision indicating a somewhat higher goal than the last. These revisions were as follows:

REVISION	1960 GOAL (BILLION CUBIC METERS)
First	47.0 48/
Second	56.5 49/
Third	65.0 50/

These goals subsequently were cancelled with the abolishment of the Sixth Five Year Plan and the introduction of the Seven Year Plan beginning in 1959.

Although the Seven Year Plan set a goal of 148.3 billion cubic meters of natural gas for 1965, it did not establish any goals for each of the years of the period 1959-1965. Rather, these goals have been set on an annual basis with the publishing of the plan for each respective year, usually in December of the preceding year or in January of the year in question.

The introduction of the Seven Year Plan directives, beginning in 1959, should have provided the basis for an objective approach on the part of the Soviet planners to the question of setting annual production goals at more realistic levels, especially in light of continuing deficiencies in compressor installation and failures to equip more consumers to use gas. This was not the case, however. Although the goal for 1960 was set at 51.4 billion cubic meters of natural gas, a significant downward revision from the earlier hoped-for level of 65 billion cubic meters, even this reduced goal was not achieved. Furthermore, none of the annual goals during the first three years of the Seven Year Plan have been met. For the period 1959-1961 as a whole, cumulative production of natural gas has represented only 92.3 percent of the Plan, as illustrated in Table 3-30, and graphically in Figure No. 4.

Planned annual increments in natural gas extraction during the first three years of the Seven Year Plan have averaged about 14.4 billion cubic meters.* The absolute growth planned for 1962 is only 11.5 billion cubic meters and as such is the lowest absolute planned growth since 1957. Thus it is probable that the 1962 plan of 70.5 billion cubic meters is in line with the capability to deliver and, more likely, the goal has been set at a level low enough to be exceeded.

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* Based on difference between annual plan and production in the preceeding year.

Figure No. 4

SHORTFALLS IN THE PRODUCTION OF NATURAL GAS IN THE FIRST THREE YEARS OF THE SEVEN YEAR PLAN 1959-1961

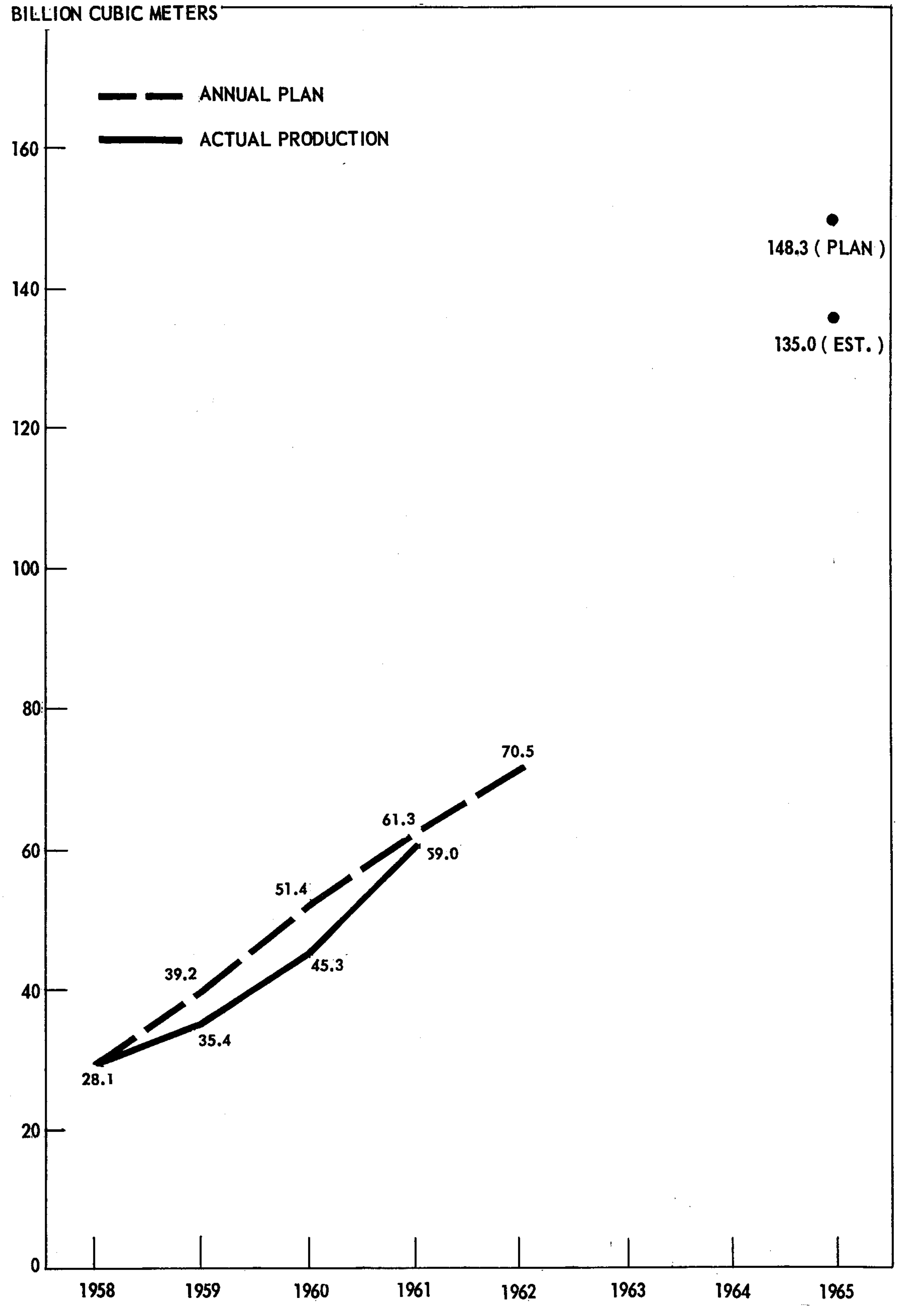

TABLE 3-30

NATURAL GAS PRODUCTION FAILURE IN FIRST THREE YEARS OF THE SEVEN YEAR PLAN (1959-61) (Billion Cubic Meters)

YEAR	PLANNED OUTPUT OF NATURAL GAS	REPORTED PRODUCTION	SHORTAGE	PERCENTAGE FULFILLMENT OF ANNUAL GOAL
1959	39.2 a/	35.4	3.8	90.3
1960	51.4 b/	45.3	6.1	88.1
1961	61.3 c/	59.5	1.8	97.1
TOTAL 1959-61	151.9	140.2	11.7	92.3

a/ 51/
b/ 52/
c/ 53/

Despite the failure to meet any of the annual goals so far during the Seven Year Plan, no known official revision of the 1965 goal of 148.3 billion cubic meters of natural gas has been made. There has been a shift, however, in the plan for regional production of natural gas for 1965. Within this shift, production of natural gas in the RSFSR is to decline by about 8 billion cubic meters, to 75.9 billion cubic meters. This decline is to be offset primarily by increases in production in the Ukraine (the Shebelinka deposit) and in the Uzbek Republic (the Gazli field). This shift is illustrated in Table 3-31.

Nevertheless, it is extremely unlikely that the 1965 goal will be met. Based on past industry performances, and with little evidence that the problems which have beset the industry in the past will be solved by 1965, it is estimated that the production of natural gas in 1965 will be about 135 billion cubic meters.

Table 3-32 illustrates the declining role played by the utilization (production) of associated natural gas in the USSR. At present, about 40 to 50 percent of the natural gas produced in association with crude oil is flared off. This can be attributed to the absence of an adequate gas

TABLE 3-31

SHIFT IN THE PRODUCTION OF NATURAL GAS IN THE USSR BY REPUBLIC a/ - 1965

REPUBLIC	BILLION CUBIC METERS ORIGINAL PLAN a/	BILLION CUBIC METERS REVISED b/
RSFSR	83.750	75.930
Azerbaydzhan	11.600	11.600
Ukraine	31.450	36.000
Uzbek	18.300	21.580
Kirgiz	2.070	2.070
Kazakh	0.060	1.210
Turkmen	1.050	1.400
TOTAL	148.280	149.790 c/

a/ 54/
b/ 55/
c/ No significance is attached to the minor upward revision.

TABLE 3-32

UTILIZATION* OF ASSOCIATED NATURAL GAS IN THE USSR a/ - 1950-60 AND 1965 PLAN

YEAR	AMOUNT (MILLION CUBIC METERS)	PERCENT OF TOTAL NATURAL GAS
1950	2,144.8	37.2
1951	2,433.0	38.9
1952	2,469.9	38.7
1953	2,495.6	36.3
1954	2,603.9	34.7
1955	3,114.9	34.7
1956	4,029.9	33.4
1957	4,488.1	24.2
1958	5,563.0	19.8
1959	6,528.0 b/	18.4
1960	8.090.5 b/	17.9
1965 Plan	15,400.0	10.4

* Recorded as production.
a/ Except where noted, from 56/.
b/ 57/

collecting system, which, in turn, has resulted from a shortage of steel pipe. Efforts are being made to increase the production of asbestos-cement pipe, which has proved a successful substitute for steel pipe in associated gas transport.

2. Regional Distribution

The production of natural gas in the USSR for the years 1950, 1955, 1958 and 1960 is distributed according to republic and to economic region in Table 3-33. Readily apparent in this distribution is the very sharp growth in production of natural gas in the North Caucasus and in the Ukraine. Together these two producing areas accounted for almost 62 percent of total national production in 1960. These growths basically reflect the rapid development of production from the Shebelinka field in the eastern Ukraine and the Krasnodar and Stavropol' Kray fields, the latter two providing the bulk of natural gas production in the North Caucasus region. The growth in production in Azerbaydzhan has been based on development of the Karadag gas-condensate field. Growth in the Volga area has been provided by the Stepnoye field in the Saratov area and the Archeda-Zhirnovsk-Korobki group to the northwest of Stalingrad. There has been little significant change during the past ten years in production from other areas of the country. As yet, the Central Asian republics, in particular Uzbekistan, produce only minor volumes of natural gas, although as shown in Table 3-31 above, in 1965 Uzbek is to produce almost 21.6 billion cubic meters of gas. This expansion is dependent, of course, on the completion of the dual 40-inch gas pipeline to the Ural industrial region.

3. Reserves *

Despite considerable fluctuations in the seven-year period 1955-1961 with respect to meeting planned goals for additions to proved reserves of natural gas, cumulative additions during these years were in excess of plan. As of January 1, 1961, the ratio of proved reserves to production for non-associated natural gas was about 54 to 1. The plan for increments to proved reserves and the reported increment for each of the years 1955-1961 is given in Table 3-34.

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* In contrast to the lack of published data on proved reserves of crude oil, the USSR reports on a continuing basis data on proved reserves of natural gas.

TABLE 3-33

REGIONAL AND REPUBLIC PRODUCTION
OF NATURAL GAS IN THE USSR
1950, 1955, 1958 AND 1960
(Billion Cubic Meters)

REPUBLIC	ECONOMIC REGION	1950 (a/b/)	1955 (a/c/)	1958 (a/b/)	1960 (a/d/e/)
RSFSR	North (Ib)	1.076	1.076	1.139	1.000
	North Caucasus (IV)	0.322	0.595	5.851	13.695
	Volga (VI)	0.887	1.627	5.164	7.556
	Urals (VIII)	0.497	0.800	1.318	1.825
	Far East (XII) f/	0.085	0.193	0.271	0.336
	TOTAL RSFSR	2.867	4.291	13.743	24.412
Ukraine)		1.536	2.928	9.501	14.286
Moldavia)	South (III)	0	0	0	0.002
	TOTAL SOUTH (III)	1.536	2.928	9.501	14.288
Azerbaydzhan	Transcaucasus (V)	1.233	1.494	4.446	5.841
Kazakhstan	Kazakhstan (Xa)	0.007	0.025	0.042	0.039
Uzbek)		0.052	0.103	0.126	0.447
Kirgiz)	Central Asia (Xb)	0	0	0.002	0.041
Turkmen)		0.064	0.141	0.224	0.234
	TOTAL KAZAKHSTAN AND CENTRAL ASIA (X)	0.123	0.269	0.394	0.761
	TOTAL USSR g/	5.761	8.981	28.085	45.303

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a/ 58/
b/ 59/
c/ 60/
d/ 61/
e/ 62/
f/ All from Sakhalin Island.
g/ Because of rounding, totals may not equal the sum of the components.

TABLE 3-34

FLUCTUATIONS IN MEETING PLANNED ADDITIONS TO PROVED RESERVES OF NATURAL GAS - 1955-61
(Billion Cubic Meters)

YEAR	PLAN	REPORTED a/	REPORTED AS PERCENT OF PLAN
1955	75	102.8	137.1
1956	84	96.4	114.8
1957	116	111.0	95.7
1958	202	289.4	143.3
1959	359 b/	696.6	194.0
1960	411 b/	226.0	55.0
1961	303	133.2	44.0
TOTAL 1955-61	1,550	1,655.4	106.8

a/ Derived from Table 3-35.
b/ 63/

Because of the success in the first two years of the Seven Year Plan in adding to proved reserves, the goal for proved reserves as of January 1, 1966 has been revised upward by almost 23 percent, to 4,185 billion cubic meters, although the increment obtained in 1961 and that planned for 1962 would indicate that some difficulty might be encountered in meeting even the original goal. Proved reserves of natural gas in the USSR for 1940, 1947-61 and the 1962 and 1965 Plans are given in Table 3-35.

A distribution of proved reserves of natural gas by economic region of the USSR on January 1 of the years 1955, 1960, and 1966 is given in Table 3-36. This distribution emphasizes the growing importance of the eastern regions of the USSR, particularly of Central Asia, in the availability of proved reserves, and the concomitant decline in the Caucasus, despite a significant absolute growth.

TABLE 3-35

PROVED RESERVES OF NON-ASSOCIATED NATURAL GAS IN THE USSR a/
1940, 1947-61, AND 1962 AND 1965 PLANS

BEGINNING OF YEAR		AMOUNT (BILLION CUBIC METERS)
1940		15.0
1947		58.8
1948		72.6
1949		74.8
1950		92.6
1951		148.9
1952		223.7
1953		247.9
1954		343.5
1955		388.8
1956		491.6
1957		488.0
1958		699.0
1959		988.4
1960		1,685.0
1961		1,911.0 b/
1962		2,044.2 c/
1963		2,275.0 c/
1966	Original Plan	3,411,3 d/
1966	Revised Plan	4,185.0 b/

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a/ Unless otherwise noted, from 64/.
b/ 65/
c/ 66/
d/ 67/

TABLE 3-36

REGIONAL DISTRIBUTION OF PROVED RESERVES OF NATURAL GAS IN THE USSR 1955, 1960 AND 1966

REGION	JANUARY 1, 1955 a/ BCM	PERCENT TOTAL	JANUARY 1, 1960 b/ BCM	PERCENT TOTAL	JANUARY 1, 1966 b/ BCM	PERCENT TOTAL
North	16.0	4.1	13.5	0.8	62.8	1.5
Volga	36.0	9.3	165.1	9.8	481.3	11.5
Caucasus	229.2	58.9	603.2	35.8	1,100.8	26.3
Ukraine	103.0	26.5	360.6	21.4	707.3	16.9
PriCaspian Depression	-	-	-	-	100.4	2.4
TOTAL	384.2	98.8	1,142.4	67.8	2,452.6	58.6
Urals	1.0	0.3	23.6	1.4	163.2	3.9
West Siberia)			25.3	1.5	205.1	4.9
East Siberia) and Far East)	0.8	0.2	1.7	0.1	96.3	2.3
Central Asia	3.0	0.7	492.0	29.2	1,268.0	30.3
TOTAL	4.8	1.2	542.6	32.2	1,732.6	41.4
TOTAL USSR	389.0	100.0	1,685.0 c/	100.0	4,185.2	100.0

a/ 68/
b/ 69/
c/ Some three-fourths of the USSR reserves are to be found in these four major areas:

GEOGRAPHIC AREA	GAS AREA	PERCENT (JANUARY 1, 1961)
North Caucasus	Krasnodar Kray	16.4
	Stavropol' Kray	13.2
Ukraine	Dashava-Shebelinka	20.0
Uzbek (in Central Asia)	Gazli-Kagan	25.6
	TOTAL	75.2

4. Costs

The reported costs of production of non-associated natural gas in the USSR has been steadily declining since 1955 and is to continue to decline through 1965. In that year, the cost of production of non-associated natural gas--planned at 36 kopecks per 1,000 cubic meter--is to be about one-fourth the cost of production in 1955. The continued and planned decline in cost of production has been possible through the increased exploitation of the very rich gas deposits at Gazli in the Uzbek Republic and the multiple fields in Krasnodar Kray. Costs of production of natural gas in individual fields or regions for 1965 are to be as follows: 70/

REGION OR FIELD	RUBLES PER 1,000 CUBIC METERS
Ukraine	0.44
Uzbek	0.22
PoVolga	0.23
Krasnodar Kray	0.31

The costs of production of non-associated natural gas for the years 1955-1960 and that planned for 1965 are given in Table 3-37. As is the case in the revealed costs of production of crude oil (and associated natural gas) these costs do not include expenditures in geological-exploratory work and, therefore, probably represent a substantial understatement of the real costs.

The 1960 costs of production of natural gas for certain of the larger fields are well below the national average and even compare favorably with planned costs for 1965. The cost of production of natural gas in the Stavropol'sovnarkhoz (the Stavropol' fields) averaged only 0.13 rubles per 1,000 cubic meters in 1960; in the Kharkov sovnarkhoz (Shebelinka)--0.29 rubles per 1,000 cubic meters; and in the L'vov sovnarkhoz (Dashava)--0.49 rubles. 75/

TABLE 3-37

COSTS OF PRODUCTION OF NON-ASSOCIATED NATURAL GAS IN THE USSR 1955-60 AND 1965 PLAN

YEAR	RUBLES/ 1,000 CUBIC METERS	INDEX
1955	1.48 a/	100.0
1956	1.33 b/	89.9
1957	0.96 b/	64.9
1958	0.66 c/	44.6
1959	0.61 c/	41.2
1960	0.59 a/	39.9
1965 Plan	0.36 d/	24.3

a/ 71/
b/ 72/
c/ 73/
d/ 74/

5. Exports

At present, only minor quantities of natural gas are exported from the USSR. These quantities, which totalled 242 million cubic meters in 1960, and which represent no substantial change since 1955, are delivered to Poland by means of a pipeline originating in the Dashava fields of the Western Ukraine. No change in the volumes exported is anticipated until after 1965, when a second pipeline from the Dashava fields to Poland is scheduled for completion. Upon completion of this pipeline, exports of natural gas to Poland probably will be in excess of 1 billion cubic meters per year.

The possibility that the Soviet Union will attempt to export major volumes of natural gas to the Scandinavian countries must not be overlooked. Such overtures on the part of the USSR already have been made to Sweden and to Finland. 76/ The USSR reportedly offered to supply Finland with natural gas made available by a pipeline laid under the Gulf of Finland and also has indicated that Sweden could be supplied with Soviet natural gas through plastic pipelines laid under the Baltic

Sea. Although the reported proposal appears dubious because of the impracticability today of using plastic pipe and the unnecessary complication of a water crossing to Finland, it must be recognized that natural gas could be easily exported to Finland possibly by more conventional approaches.

Another possibility, and probably of greater credibility, would be to supply the countries of East Europe with natural gas by means of a transmission gas pipeline system paralleling the Comecon crude oil pipeline. Natural gas is available in large quantities in the Western Ukraine and in the North Caucasus. These deposits are located much closer to potential consumers in East Europe than are the oil fields of the Urals-Volga.

Finally, the Soviet Union has given thought to the export of liquefied petroleum gases. In an article outlining the development of liquefied petroleum gas production during the Seven Year Plan, the following statement was made: "liquefied gases (propane and butane), which will be produced in increasing quantities in our country, will be used not only for the needs of the Soviet Union, but will be exported to other countries by means of special tankers. This will provide an additional means of strengthening the economic relations of the Soviet Union with foreign countries and will serve as a major contribution to the expansion of trade." 77/

6. Projections for 1970, 1975 and 1980

Soviet planners have set tentative long-range goals for the production of gas as follows (billion cubic meters):

1970	310/325	78/
1975	500	79/
1980	680/720	80/

It will be noted that by 1980, gas production is to reach 680-720 billion cubic meters. To achieve this goal and those for the preceding years, a schedule of increments to proved reserves and volumes of exploratory drilling has been established. During the 20-year period it is planned to prepare 17,237 billion cubic meters of proved reserves of non-associated natural gas. By January 1, 1981, proved reserves of non-associated natural gas are to reach 12,988 billion cubic meters, which will provide a reserves/production ratio of about 20-1. Because the USSR estimates its potential gas reserves to be on the order of 60 trillion cubic meters, the discovery of more than 17 trillion cubic meters of non-associated natural gas in a twenty-year period should not be an insurmountable problem, although it is an impressive goal. The distribution of this 60 trillion cubic meter potential by republic and region of the USSR is given in the following Table:

TABLE 3-38

NATURAL GAS POTENTIAL OF THE USSR a/

AREA	AMOUNT (TRILLION CUBIC METERS)		PERCENT OF TOTAL	
RSFSR	32.5		54.2	
Soviet North		2.0		3.4
Urals-Volga		12.0		20.0
North Caucasus		7.0		11.7
West Siberia		5.0		8.3
East Siberia and Far East		6.0		10.0
Other		0.5		0.8
Ukraine and Moldavia	5.1		8.5	
Azerbaydzhan	3.0		5.0	
Kazakhstan	5.0		8.3	
Georgia and Armenia	0.9		1.5	
Uzbek	5.0		8.3	
Turkmen	7.0		11.7	
Kirgiz and Tadzhik	1.0		1.7	
Other	0.5		0.8	
TOTAL	60.0		100.0	

a/ 81/

To guarantee the discovery of the 17,237 billion cubic meters during 1961-1980, a total of 86.57 million meters of exploratory drilling has been planned. This total has been broken into individual 5-year period requirements, as have been production, cumulative production, and increments to proved reserves. Data for these 5-year periods are given in Table 3-39. No estimate for development drilling for natural gas is available.

TABLE 3-39

AMOUNT OF EXPLORATORY DRILLING, PRODUCTION AND GROWTH OF NATURAL GAS* RESERVES IN THE USSR, BY 5-YEAR PERIOD a/
1961 - 1980

5-YEAR PERIOD	PRODUCTION IN LAST YEAR OF 5-YEAR PERIOD* (BCM)***	CUMULATIVE PRODUCTION DURING 5-YEAR PERIOD (BCM)***	RESERVES PRODUCTION RATIO	INCREMENT IN RESERVES (BCM)***	RESERVES ON JANUARY 1 OF 5-YEAR PERIOD (BCM)***	AMOUNT OF EXPLORATORY DRILLING** (THOUSAND METERS)
1961-65	131.7	454	31-1	2,600	2,034.7	11,820
1966-70	280.0	1,098	25-1	4,100	4,185.0	19,100
1971-75	452.0	1,908	22-1	5,047	7,187.0	25,750
1976-80	646.0	2,833	20-1	5,490	10,331.0	29,900
TOTAL		6,293		17,237		86,570

* Non-associated natural gas only.
** Including 320,000 meters for delineation of underground storage during 1961-65 and 500,000 meters in each successive 5-year period.
*** Billion cubic meters.
a/ 82/

At the present time, the USSR has 30 defined gas-bearing regions. Of these, only 15 are under commercial exploitation. During the next 20 years Soviet authorities estimate that 19,200 wells will be required for the planned development of gas production. At the beginning of 1960, there were only 1,188 producing gas wells in the USSR. 83/

The Soviet estimates of the probable regional and republic production of natural gas in the USSR in 1980 are given in Table 3-40. The most dramatic shift in the regional production of natural gas which is to take place during 1961-80 is the growth in the share of the Central Asian republics of Uzbek, Tadzhik, Kirgiz and Turkmen. In 1960 these republics accounted for only 1.6 percent of the total national output of natural gas, but by 1980, this share is to increase to 24.3 percent. Both in terms of percentage and absolute growth, that which has been planned for the Central Asian republics far exceeds any other area of the Soviet Union.

In summation, it is probable that the USSR reserves of natural gas are adequate to support the program which has been established for the 1961-1980 period. As in the case of the program designed to expand the production of crude oil, however, drilling tools and equipment and drilling technology may be the critical factor in determining the ability of the USSR to find the required volumes of reserves. It is expected that the major gas finds and development will be at a depth of 3,000 to 3,500 meters. 86/ Thus far, the USSR has met with considerable difficulty in drilling to such depths economically and effectively. The success of their future effort will depend upon their ability to develop improved technology and equipment or to obtain such equipment and knowhow from the West. In addition, it will be necessary to improve on the past record in equipping potential gas consumers and in installing transmission equipment.

C. Natural Gas Liquids

An examination in detail of the current Soviet literature has revealed a considerable degree of confusion in the treatment of statistics on the current levels of production and consumption of natural gas liquids and plans for increases in output. Soviet statistics are often misleading in that it seldom can be determined whether production data on LPG include those amounts produced by refineries. In addition, there is virtually no information published on the output of natural gasoline. Thus,

TABLE 3-40

SOVIET ESTIMATES OF THE
PROBABLE REGIONAL AND REPUBLIC PRODUCTION
OF NATURAL GAS IN THE USSR a/ - 1980

REPUBLIC	ECONOMIC REGION	AMOUNT (BILLION CUBIC METERS)	PERCENT OF TOTAL
RSFSR	North (Ib)	20.0	2.8
	North Caucasus (IV)	91.0 c/	12.6
	Urals-Volga (VI & VIII)	155.0	21.5
	Siberia (IX & XI)	75.0 b/	10.4
	Far East (XII)	21.0	2.9
	TOTAL RSFSR	362.0 d/	50.3 d/
Ukraine	South (III)	110.7	15.2
Azerbaydzhan) Georgia) Armenia)	Transcaucasus (V)	32.0 b/	4.4
Kazakhstan	Kazakhstan (Xa)	41.6	5.8
Uzbek) Tadzhik) Kirgiz) Turkmen)	Central Asia (Xb)	175.0	24.3
	TOTAL REGION (X)	216.6	30.1
	TOTAL USSR	720.0 d/ e/	100.0

a/ 84/
b/ 85/
c/ Residual.
d/ Derived independently and does not equal the sum of the components.
e/ High side of 680-720 billion cubic meter range for 1980.

the data and estimates presented in this section must be regarded as quite tenuous and subject to considerable revision and re-interpretation upon the availability of additional information.

Until the formation of Soyuzgaz (All-Union Gas, an independent trust of the Main Administration of the Gas Industry) in 1959, the development of the production and consumption of LPG and of natural gas liquids in general in the USSR had lagged considerably behind the potential available. Lacking was a central planning body with sufficient authority and an access to the capital required to ensure the establishment of this particular phase of the fuels industry. The Seven Year Plan called for the production in 1965 of 6.5 million tons of natural gas liquids 87/ and for the construction during these years of 20 natural gasoline plants. 88/ Of the planned production for 1965, the chemical industry was to take about 50 percent. Only 20 percent was allocated for domestic use in heating and cooking.

Of the total of 6.5 million tons of natural gas liquids planned for 1965, 3.8 million tons were to be LPG. Since the publishing of the plan, the planned output of LPG apparently has been revised upward, to between 4.4-4.7 million tons. 89/ This apparent revision may be based on anticipated increases in the demand for LPG, following 30 percent reductions in both the wholesale price and in the cost of rail transport. 90/

The consumption of LPG* in the USSR has increased during 1957-61 to the following levels: 91/

YEAR	THOUSAND TONS
1957	73
1958	108
1959	148
1960	350
1961	487

During the remaining years of the Seven Year Plan, output of LPG is to increase quite rapidly, as shown below:

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* Data presented below on LPG exclude output from refineries.

YEAR	PLANNED OUTPUT OF LPG (THOUSAND TONS)
1962	730 92/
1963	1,850 92/
1964	3,100 92/
1965	4,400 92/ to 4,700 93/

The major problems currently confronting expansion in the use of LPG in the USSR include the lack of consuming equipment (stoves and space heaters, for example), a lack of transport and storage facilities, reduced requirements for LPG in the chemical industry following failure in that industry to meet certain of its plans, a lack of associated natural gas collection facilities, shortages of crude oil stabilization equipment and failure to meet natural gasoline plant construction schedules.

At present all of the natural gasoline produced in the USSR is directed to refineries where it is blended in motor fuels.

The Committee believes that achievement of the Seven Year Plan goals for the production of natural gas liquids may not be realistic in terms of current capability and in view of the number of problems facing the acceptable development of this industry. On this basis, the Committee estimates that the output of natural gas liquids in the USSR in 1965 probably will fall within the range of 3 to 4 million tons.

SECTION 10

REFINING OF CRUDE OIL

A. Summary and Conclusions

The Seven Year Plan (1959-65) originally called for an increase in primary distillation capacity* of 110-120 percent (134-146 million tons per year). This was subsequently raised to 120-130 percent (146-158 million tons per year). However, the latter goal seems unrealistic. Analysis of available data seems to indicate that the plans are actually to increase the capacity for primary distillation of crude oil by about 130 million tons during this period. Such an increase would mean an estimated capacity of 250 million tons in 1965, compared with an estimated 122 million tons in 1958. Operated according to current Soviet practice, at about 85 percent of capacity, 250 million tons of refining capacity would be adequate to process a crude oil charge of 214 million tons and would yield 197 million tons of nongas products. It is estimated that the USSR will consume about 180 million tons of petroleum products in 1965. When production of synthetic petroleum products and natural gasoline is taken into account, as much as 22 million tons of petroleum products could be available for export in that year. The bulk of the Soviet Union's exports of petroleum, however, will be in the form of crude oil, which requires much less expenditure for capital and which presents the greatest opportunity for return on their capital.

The addition of 130 million tons of crude oil charge capacity during the years 1959-65 apparently is to require an investment of approximately 3.6 billion rubles. This investment, which amounts to about 2.8 percent of the total investment planned for all industry during the Seven Year Plan, and about 27.6 percent of investment planned for the oil industry, may be divided roughly as 3.0 billion rubles for construction of new refineries and 0.6 billion rubles for expansion and modernization of facilities operating in 1958.

Of the 130 million tons to be added to refining capacity, about 95 million tons apparently are to be located in 17 major

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* Capacity ratings are in metric tons per year. One million metric tons per year equals approximately 20,000 barrels per day.

new refineries, and about 35 million tons are to be added by expanding and modernizing facilities which existed in 1958. By the end of 1960, eleven of the 17 new refineries were in varying stages of construction. Total capacity is estimated to have risen to 157 million tons by 1960. This increase of about 37 million tons in two years is compatible with the average annual increase that would be required if the estimated goal is to be achieved. It is probable that during the Seven Year Plan, 70 million tons of capacity can be added in the 11 new refineries under construction in 1960 and that 35 million tons can be added by expansion and modernization of old refineries. Achievement of a capacity of 250 million tons in 1965 probably depends largely upon the installation of 25 million tons of capacity in 6 sites which were either not developed or were in very early stages of development in mid-1961.

Completion, by 1965, of these 6 refineries will depend on considerably better performance in construction than has been usual in the past.

Traditionally, Soviet efforts in the construction of refineries have been dispersed over a large number of projects, and construction times have been extremely long in comparison to the time that equivalent construction would require in the United States. Prior to the beginning of the Seven Year Plan the norm for construction of a standard design refinery having a crude oil charge capacity of 6 million tons was 7.5 years, but actual construction time typically exceeded the norm. (In practice the capacity of these standard design refineries apparently has been expanded to 6.6 million tons.) In 1958, the norm was reduced to 3 to 4 years, which is much more nearly in conformance with western practice. Efforts also were to be concentrated on a smaller number of projects at any one time.

With such concentration of effort it is possible that the 6 refineries in question could be completed by 1965. In the light of past construction records, however, such achievement appears doubtful. Their completion, however, is not absolutely essential to attainment of refining objectives. If it is assumed that all 6 are to be standard design refineries with a capacity of 6.6 million tons each, addition of the desired 25 million tons would require completion of only about 63 percent of their capacity. Even if only one-third of their capacity, i.e. 13 million tons, were completed by 1965, total refining capacity probably would be 238 million tons. With this capacity a crude oil charge of 214 million tons probably could still be processed and a product yield of 197 million tons obtained by operating the refineries at 90 percent of capacity. This level of utilization, if necessary, probably could be attained and maintained, for a time, in Soviet refineries. Thus it appears that the Soviets will have enough refining capacity to process, in some manner or other, the crude oil charge of 214 million tons implied by available data on planned consumption and by the program for refinery construction. The output of refined products probably will substantially exceed the 180 million tons estimated as required for domestic consumption.

Although primary distillation facilities probably will be adequate to process a crude oil charge of 214 million tons in 1965, it is not equally certain that there will be sufficient secondary refining facilities to insure the desired qualities and proportions in the product mix.

Excess low-quality straight-run gasoline is being used wherever possible in light diesel fuel blends. Such use increases the output of the desired diesel fuel, lowers the initial freezing point of the diesel fuel for frigid weather service, and reduces the potential excess of gasoline. The percentage yield of gasoline apparently began to decrease in 1960 and appears to be projected for further decrease by 1965. Reduction in the desired percentage yield of gasoline should result in improved quality of gasoline.

Officials of the Soviet oil industry mention quite frequently the problem of naphtha surplus; so it would not be at all unlikely for the USSR to attempt to penetrate the Free World market with virgin naphtha. It is unlikely, however, that they will strive to penetrate the high quality motor gasoline market because of a general lack of octane level due to lack of catalytic reforming capacity and mild operations on the catalytic cracking units. Also, the high investment costs associated with motor gasoline production will be a further deterrent.

Although Soviet literature indicates that notable gains have been achieved in secondary refining, especially in thermal conversion, catalytic cracking, and catalytic hydrotreating processes, development of secondary refining capacity is still below the level desired, particularly for the production of diesel fuels, which were reported to be in short supply in 1960.

It is probable that considerably more emphasis will have to be placed on the construction and installation of secondary refining capacity if the qualities and proportions apparently desired for the product mix in 1965 are to be achieved.

B. Refining Capacity in 1958

In 1958, the last year before the beginning of the Seven Year Plan, the crude oil charge capacity of petroleum refineries in the Soviet Union is estimated to have been about 122 million tons.* In that year Soviet refineries processed a total of approximately 104 million tons of crude oil and produced nearly 96 million tons of nongas products.** This operation in 1958 at nearly 87 percent of capacity represented a considerably more intensive utilization of facilities than had prevailed in earlier years. In 1955, the estimated total refinery charge of 68.4 million tons amounted to only about 76 percent of the available capacity. Since 1955, the operation of refineries at about 85 percent of capacity has become normal Soviet practice.

C. The Goal for Refining Capacity in 1965

The Seven Year Plan originally called for an increase in primary distillation capacity of 110-120 percent compared to 1958. This goal subsequently was raised to 120-130 percent.1/ The revised goal implies that a capacity of 268-280 million tons was planned for 1965. Such a goal seems unreasonably high in comparison with the planned production of crude oil, the estimated domestic demand, the probable opportunities for exporting refined products, and the present status of refinery construction. However, Soviet planning frequently provides for reserve industrial capacity which less frequently is realized in actual practice.

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* Estimated annual service capacity. Annual service capacity is the crude oil charge capacity actually available for use during the calendar year, allowing for normal down-time in clean-out, maintenance, and repair. Throughout this section the terms "crude charge capacity", "annual service capacity", and "primary distillation capacity" are synonymous.

** Refinery gas and loss have been estimated at a constant 8 percent of the crude oil charge; total output of nongas products at a constant 92 percent of the charge.

Analysis of available information concerning the production of specific products planned for 1965 indicates that an annual service capacity of about 250 million tons may be planned for 1965.* A capacity of this magnitude in 1965 is not necessarily incompatible with the percentage increases contained in the plan as the plan goal probably related to year-end capacities which would be greater than the service capacity actually available for use during either 1958 or 1965.

Of the 130 million tons of capacity to be added between 1958 and 1965, about 95 million tons will be located in 17 major new refineries and about 35 million tons are to be added by expansion and modernization of existing facilities.

Of these 17 new refineries, the following 11 will account for the addition of nearly 70 million tons of new capacity:

NEW REFINERY	CRUDE CHARGE CAPACITY a/ TO BE ADDED BY 1965 (IN MILLIONS OF TONS)
Novo-Gor'kiy	2.6
Omsk	8.9
Stalingrad	4.0
Perm'	6.5
Fergana	5.9
Ryazan'	6.6
Angarsk	12.6
Kritovo	2.6
Pavlodar	6.6
Polotsk	6.6
Novo-Yaroslavl'	6.6
TOTAL	69.5

a/ Service capacity for the primary distillation of crude oil. Estimates of capacities at individual refineries mentioned in this report were derived from numerous sources.

* For a more detailed discussion of the derivation of this figure, see Appendix A, Refining Methodology, page 162.

The 35 million tons of capacity to be added during the Seven Year Plan by construction of new facilities and modernization of old facilities at refineries already existing in 1958, is a continuation of a program announced for the Sixth Five Year Plan (1956-60). On the basis of estimated accomplishments of that program by the end of 1958, about 15 million tons of capacity could be added during the Seven Year Plan by extremely low cost modernization of old facilities, and 20 million tons would be added by construction of additional facilities in old plants.

Table 3-41 indicates the capacities and locations of Soviet refineries from 1950 through 1960 with a projection for 1965. Map No. 4 illustrates the location and capacities of refineries in the USSR.

D. Factors Affecting the Type of Facilities to be Added

1. Quality of Soviet Crude Oils

About two-thirds of the total annual production of crude oil in the USSR as of 1959-60 came from the Urals-Volga region. By 1965, the output of crude oil in this region may constitute 75 percent of total Soviet production of crude oil. A high salt content (as much as 700 lbs./1,000 bbls.) and a rather high sulfur content (1 to 2 percent) occur in many of these Urals-Volga crude oils 17/ and create problems in refining.* Electrolytic desalting has been adopted since 1955 and plans call for the construction of catalytic hydrotreating units to reduce the sulfur content.

In addition, other properties 18/ of the crude oil cause major refining problems. The straight-run gasoline content (22-25 weight percent) has a high fixed sulfur content and a very low octane number (42-47) requiring desulfurization and catalytic processing to become a good quality product. In addition, the hydrocarbon composition of the straight-run fraction of light diesel fuel is not suited for making a winter-grade of diesel fuel.

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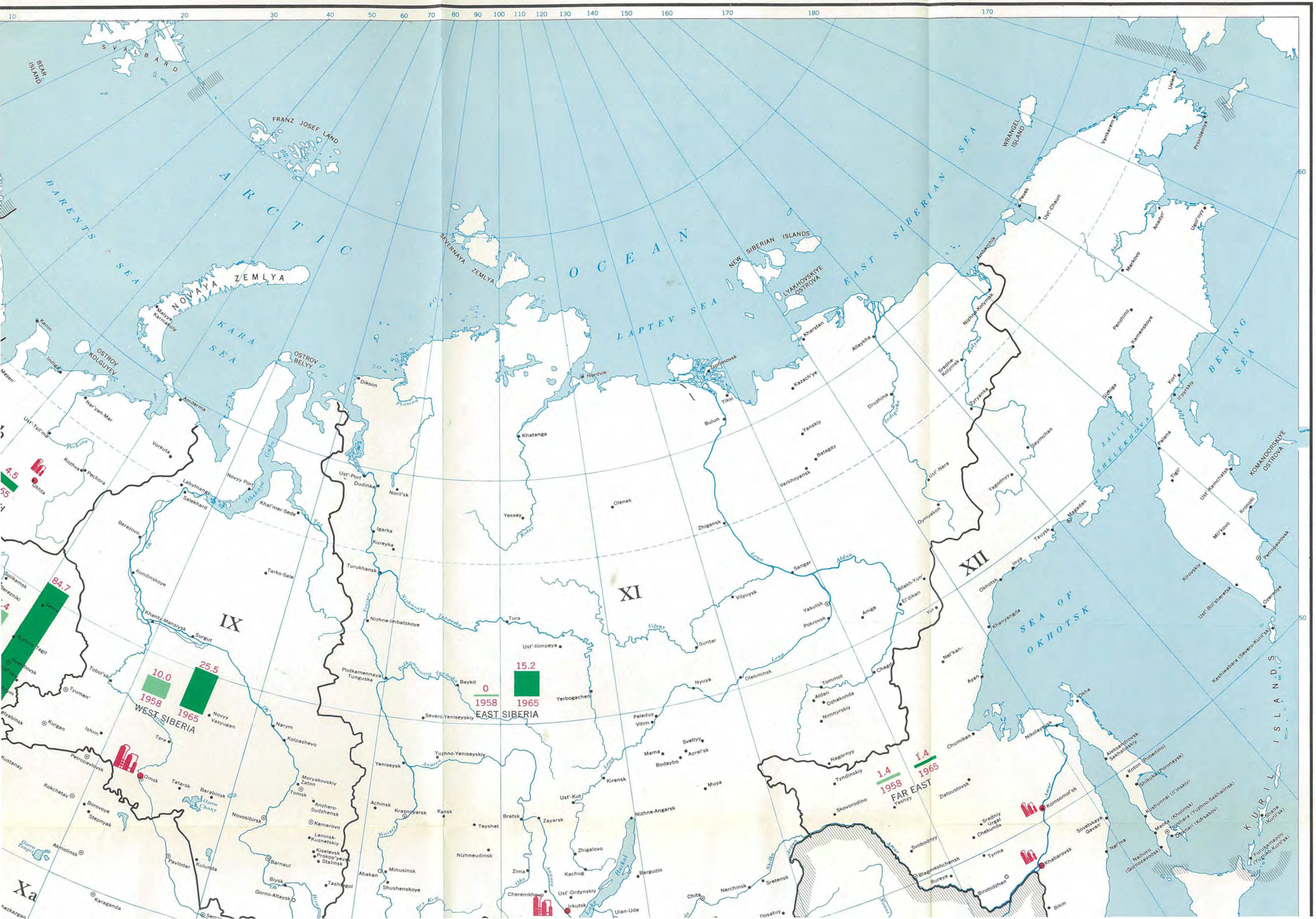
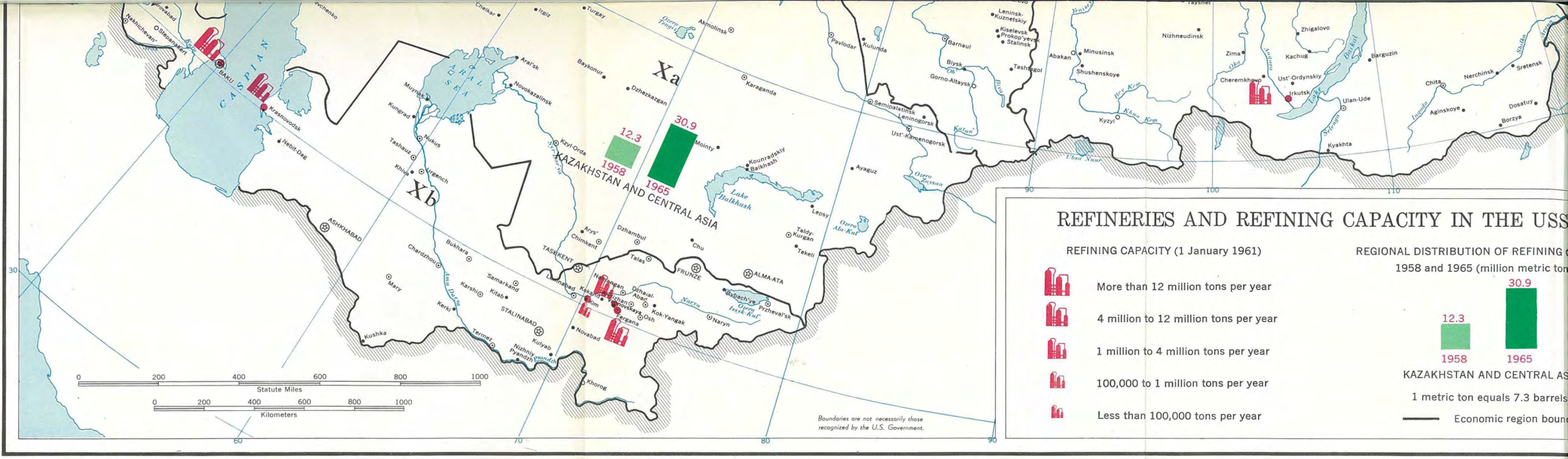
* The Urals-Volga fields also produce oils with lower sulfur and salt content than indicated above. Such crude oils have been exported to the Free World and are equal in quality to crude oils from non-Bloc sources.

MAP NO. 4

ARCTIC OCEAN
BARENTS SEA
KARA SEA
LAPTEV SEA
BALTIC SEA
BLACK SEA
CASPIAN SEA
ARAL SEA
Gulf of Bothnia
Gulf of Finland
WHITE SEA
SVALBARD
BEAR ISLAND
FRANZ JOSEF LAND
NOVAYA ZEMLYA
SEVERNAYA ZEMLYA
NEW SIBERIAN ISLANDS
LYAKHOVSKIYE OSTROVA
OSTROV KOLGUYEV
OSTROV BELYY
Ia
Ib
IIa
IIb
III
IV
V
VI
VII
VIII
IX
Xa
XI
BALTIC
0
1958
10.8
1965
SOVIET NORTH
0.3
1958
4.5
1965
UKRAINE
1.6
1958
14.1
1965
CENTRAL
4.4
1958
21.7
1965
CAUCASUS
36.7
1958
42.9
1965
URALS-VOLGA
55.4
1958
84.7
1965
WEST SIBERIA
10.0
1958
25.5
1965
EAST SIBERIA
0
1958
15.2
1965
MOSCOW
KIEV
MINSK
RIGA
VILNIUS
TALLINN
HELSINKI
WARSAW
Leningrad
Murmansk
Archangel
Vorkuta
Ukhta
Perm'
Sverdlovsk
Chelyabinsk
Omsk
Novosibirsk
Stalingrad
Astrakhan'
BAKU
TIFLIS
YEREVAN
Groznyy
Kuybyshev
Ufa
Orsk
Gur'yev
Krasnodar
Stavropol'
Noril'sk
Dudinka
Igarka
Tura
Irkutsk
Bratsk
Kirensk
Khatanga
Tiksi
Nordvik
Dikson
Salekhard
Surgut
Tobol'sk
Tyumen'
Narym
Tomsk
Kemerovo
Barnaul
Krasnoyarsk
Chita



SVALBARD
BEAR ISLAND
FRANZ JOSEF LAND
ARCTIC OCEAN
BARENTS SEA
NOVAYA ZEMLYA
KARA SEA
SEVERNAYA ZEMLYA
LAPTEV SEA
NEW SIBERIAN ISLANDS
LYAKHOVSKIYE OSTROVA
EAST SIBERIAN SEA
WRANGEL ISLAND
BERING SEA
SEA OF OKHOTSK
ZALIV SHELEKHOVA
KOMANDORSKIYE OSTROVA
KURIL ISLANDS
OSTROV KOLGUYEV
OSTROV BELYY
IX
XI
XII
Xa
10.0
1958
25.5
1965
WEST SIBERIA
0
1958
15.2
1965
EAST SIBERIA
1.4
1958
1.4
1965
FAR EAST
84.7
4.5
Vorkuta
Labytnangi
Salekhard
Novyy Port
Khal'mer-Sede
Berezovo
Kondinskoye
Tarko-Sale
Khanty-Mansiysk
Surgut
Tobol'sk
Tyumen'
Kurgan
Ishim
Tara
Omsk
Petropavlovsk
Kokchetav
Tatarsk
Barabinsk
Novosibirsk
Tomsk
Kemerovo
Barnaul
Biysk
Gorno-Altaysk
Pavlodar
Kulunda
Karaganda
Akmolinsk
Narym
Kolpashevo
Novyy Vasyugan
Dikson
Ust'-Port
Dudinka
Noril'sk
Igarka
Kureyka
Turukhansk
Nizhne-Imbatskoye
Tura
Baykit
Podkamennaya Tunguska
Severo-Yeniseyskiy
Yuzhno-Yeniseyskiy
Yeniseysk
Achinsk
Krasnoyarsk
Kansk
Tayshet
Nizhneudinsk
Minusinsk
Abakan
Shushenskoye
Bratsk
Zima
Cheremkhovo
Irkutsk
Ulan-Ude
Chita
Nerchinsk
Sretensk
Khatanga
Nordvik
Yessey
Olenek
Ust'-Ilimpeya
Yerbogachen
Kirensk
Ust'-Kut
Zhigalovo
Kachug
Ust'-Ordynskiy
Barguzin
Nizhne-Angarsk
Bodaybo
Mama
Vitim
Peleduy
Tiksi
Bulun
Zhigansk
Sangar
Vilyuysk
Yakutsk
Pokrovsk
Suntar
Olekminsk
Nyuya
Aldan
Tommot
Chagda
Amga
Verkhoyansk
Batagay
Yanskiy
Kazach'ye
Druzhina
Allaykha
Kharstan
Ust'-Nera
Oymyakon
Allakh-Yun'
El'dikan
Yur
Nel'kan
Ayan
Okhotsk
Magadan
Seymchan
Yagodnyy
Zyryanka
Srednekolymsk
Nizhne-Kolymsk
Ambarchik
Pevek
Ust'-Chaun
Anadyr'
Markovo
Penzhino
Kamenskoye
Gizhiga
Palana
Tigil'
Ust'-Kamchatsk
Petropavlovsk
Korf
Ust'-Bol'sheretsk
Ozernovskiy
Uelen
Provideniya
Okha
Nikolayevsk
Komsomol'sk
Khabarovsk
Sovetskaya Gavan'
Blagoveshchensk
Svobodnyy
Skovorodino
Tyndinskiy
Nagornyy
Chumikan
Zlatoustovsk
Birobidzhan
Bikin
Kotov (Pobedino)
Aleksandrovsk-Sakhalinskiy
Dosatuy


REFINERIES AND REFINING CAPACITY IN THE USS
REFINING CAPACITY (1 January 1961)
More than 12 million tons per year
4 million to 12 million tons per year
1 million to 4 million tons per year
100,000 to 1 million tons per year
Less than 100,000 tons per year
REGIONAL DISTRIBUTION OF REFINING
1958 and 1965 (million metric to
12.3
30.9
1958
1965
KAZAKHSTAN AND CENTRAL AS
1 metric ton equals 7.3 barrels
Economic region boun
KAZAKHSTAN AND CENTRAL ASIA
Xa
Xb
CASPIAN
ARAL SEA
Lake Balkhash
BAKU
Krasnovodsk
Nebit-Dag
ASHKHABAD
TASHKENT
STALINABAD
FRUNZE
ALMA-ATA
Karaganda
Semipalatinsk
Ust'-Kamenogorsk
Pavlodar
Barnaul
Irkutsk
Ulan-Ude
Chita
Kyzyl
Bukhara
Samarkand
Chardzhou
Fergana
Osh
Naryn
Kzyl-Orda
Dzhambul
Chimkent
Khorog
Termez
Kushka
Mary
Kerki
0 200 400 600 800 1000
Statute Miles
0 200 400 600 800 1000
Kilometers
Boundaries are not necessarily those recognized by the U.S. Government.

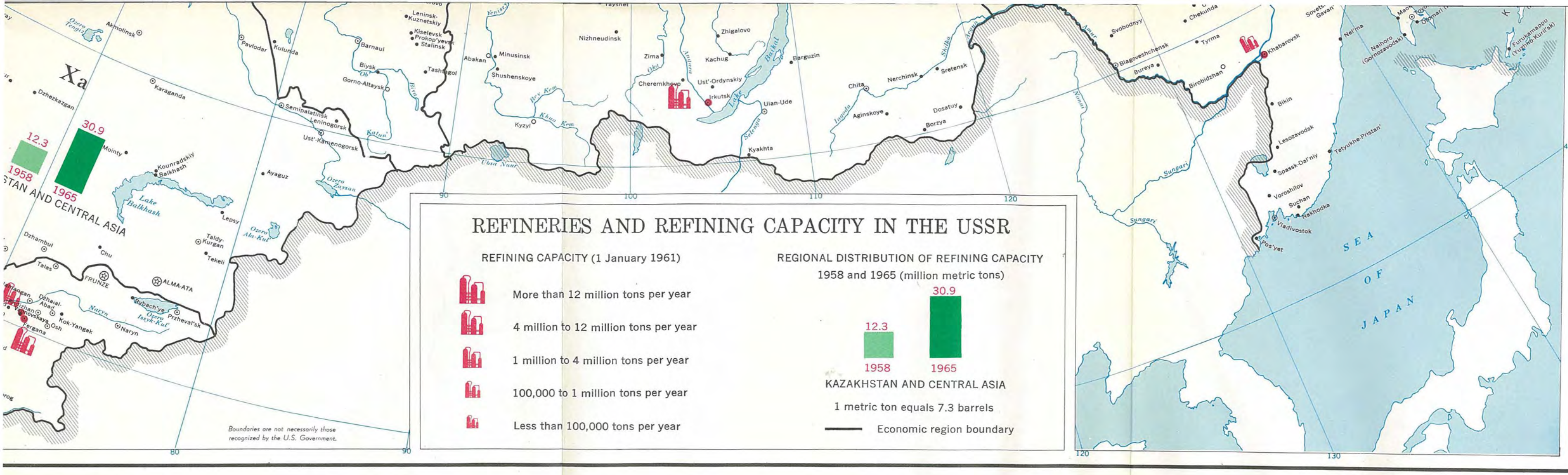

REFINERIES AND REFINING CAPACITY IN THE USSR
REFINING CAPACITY (1 January 1961)
More than 12 million tons per year
4 million to 12 million tons per year
1 million to 4 million tons per year
100,000 to 1 million tons per year
Less than 100,000 tons per year
REGIONAL DISTRIBUTION OF REFINING CAPACITY
1958 and 1965 (million metric tons)
12.3
30.9
1958
1965
KAZAKHSTAN AND CENTRAL ASIA
1 metric ton equals 7.3 barrels
Economic region boundary
Boundaries are not necessarily those recognized by the U.S. Government.
SEA OF JAPAN
Lake Baykal
Lake Balkhash
Khabarovsk
Vladivostok
Irkutsk
Ulan-Ude
Chita
ALMA-ATA
FRUNZE
Karaganda
Semipalatinsk
Barnaul
Pavlodar
Blagoveshchensk
Nakhodka
Angarsk
Cheremkhovo
Zima
Kyzyl
Abakan
Minusinsk
Biysk
Nerchinsk
Sretensk
Borzya
Kyakhta
Sovetskaya Gavan'

TABLE 3-41

ESTIMATED ANNUAL SERVICE CAPACITIES AT SPECIFIC REFINERIES IN THE USSR
1950, 1955, 1958-1960, AND ESTIMATED 1965

REFINERY COMPLEX	ORIGINAL NUMBER OF REFINERIES CONSTRUCTED	STANDARD ECONOMIC REGION MAJOR REFINERY SITE	ANNUAL PRIMARY SERVICE CAPACITY (Million Metric Tons) 1950	1955	1958	1959	1960	1965
Baku	6	V. Transcaucasus	14.9	17.2	20.0	20.6	21.0	22.0
Kuybyshev	3	VI. Volga	6.1	10.3	17.0	17.5	18.0	29.0
Ufa	3	VIII. Urals	1.5	8.8	17.0	17.5	18.0	29.0
Omsk	1	IX. West Siberia	0.0	2.5	10.0	14.5	16.0	18.9
Groznyy	2	IV. North Caucasus	6.4	10.0	10.0	10.2	12.3	13.0
Syzran'	1	VI. Volga	1.0	7.0	7.0	7.0	7.0	7.0
Krasnovodsk	1	Xb. Central Asia	2.7	5.1	5.1	6.7	6.7	6.7
Ishimbay/salavat	3	VIII. Urals	0.5	5.5	6.3	6.3	7.0	7.1
Gur'yev	1	Xa. Kazakhstan	0.5	4.8	4.8	4.9	4.9	5.0
Gor'kiy	2	VII. Central	0.6	0.6	1.0	3.2	3.6	3.6
Saratov	1	VI. Volga	1.8	2.8	3.1	3.2	3.6	3.6
Tuapse	1	IV. North Caucasus	2.0	2.5	3.1	3.1	3.1	3.1
Moskva	1	VII. Central	0.7	2.0	2.5	2.7	2.7	4.0
Fergana	1	Xb. Central Asia	0.0	0.0	0.7	2.6	5.0	6.6
Perm'	1	VIII. Urals	0.0	0.0	0.1	2.6	5.0	6.6
Stalingrad	1	VI. Volga	0.0	0.0	2.6	2.6	5.0	6.6
Batumi	1	V. Transcaucasus	2.0	2.0	2.4	2.4	3.6	3.6
Orsk	2	VIII. Urals	1.2	1.5	1.7	1.8	1.8	1.8
Vannovskaya	1	Xb. Central Asia	1.0	1.7	1.7	1.8	1.8	1.8
Krasnodar	1	IV. North Caucasus	1.0	1.0	1.2	1.2	1.2	1.2
Angarsk	1	XI. East Siberia	0.0	0.0	0.0	0.0	4.0	12.6
Ryazan'	1	VII. Central	0.0	0.0	0.0	0.0	1.0	6.6
Yaroslavl'/Konstantinovskiy	3	VII. Central	0.9	0.9	0.9	0.9	0.9	7.5
Pavlodar	1	Xa. Kazakhstan	0.0	0.0	0.0	0.0	0.0	6.6
Polotsk	1	IIb. West	0.0	0.0	0.0	0.0	0.0	6.6
Kritovo	1	XI. East Siberia	0.0	0.0	0.0	0.0	0.0	2.6
6 New Refineries Not Started on 1/1/61 a/	6							25.0
TOTAL MAJOR SITES	48		44.8	86.2	118.2	133.3	153.2	247.7
TOTAL IN 13 MINOR SITES	15		2.4	3.3	4.1	4.1	4.1	4.1
GRAND TOTAL IN USSR	63		47.2	89.5	122.3 c/	137.4 c/	157.3	251.8
TOTAL NUMBER OF SITES			30	31	34	34	36	45

a/ These six new refineries probably are to be located at Mozyr' 2/ in the southern part of the Belorussian SSR, at Kremenchug, 3/ Odessa, 4/ and a third unidentified site 5/ in the Ukrainian SSR, Kirishi, 110 kilometers southeast of Leningrad 6/, and at Chimkent 7/ in Kazakh SSR. Construction at the new site of Kremenchug apparently was in progress early in 1961. 8/ Preparatory work was done at Chimkent during 1956-57. Plans were made in 1957 for the refinery at Kirishi 9/ and work was begun on the site in 1961. 10/ A 1,500 kilometer pipeline from Al'met'yevsk, in the Urals-Volga, to Leningrad is under construction, and more than 600 kilometers had been completed by late 1961. 11/ This line will supply refineries at Gor'kiy, Yaroslavl, and Kirishi. The advanced stage of construction indicates probable completion to Kirishi by 1963.

In addition to the proposed refineries mentioned above, plans were at least tentative in 1959 for initiation of construction at 4 more new sites, apparently Ventspils 12/ Kazan'*, 13/ Al'met'yevak, 14/ and Raychichinsk. 15/ Preparatory work probably was done during 1956-57 on the site of the future plant at Raychichinsk. Nevertheless, there is some evidence that the Raychichinsk facilities in the Far East Amurskaya Oblast' of the RSFSR, and likewise some of all of the planned plants in the Ukraine, may not be even tentatively scheduled for completion until after 1965.

* A petrochemical complex including polyethylene production facilities 16/ was under construction as of early 1961 at Kazan .

2. Product Output Patterns

a. Past and Future Development

Soviet natural crude oil refining has always emphasized high percentage yields of the intermediate distillates. In the earliest phase, prevailing in the pre-World War II period, the emphasis was primarily on maximizing the yield of kerosene. The earliest postwar period featured increasing percentage yields* of light diesel fuel [19] and the principal light products [20] in total.

Table 3-42 shows the estimates of refinery yields for years 1955-1960 and 1965. These estimates were made from meager data that the Soviets publish on demand. However, it does check very well with what was reported to the American Oil Delegation. The estimate shown for 1965 is actually what would have to be obtained to balance supply with demand. The Soviets could produce to a different yield pattern, export or import to balance if it were too difficult to obtain this yield. Calculations by the Committee do indicate, however, that the USSR should be able to reach this yield pattern.

It is of interest to note that it will be necessary to decrease gasoline yield to 16 weight percent in 1965 to stay in balance. Soviet publications mention quite frequently the problem of naphtha surplus; so, it would not be at all unlikely for the USSR to attempt to penetrate the world market with virgin naphtha. It is unlikely, however, that the USSR will strive to penetrate the high quality motor gasoline market in view of a general lack of octane level caused by insufficient catalytic reforming and mild operations on the catalytic cracking units, also the high investment costs associated with motor gasoline production will be a further deterrent.

b. Fuels for Internal Combustion Engines

In the pre-World War II period, the predominant fuel for internal combustion engines in the USSR was tractor kerosene. In the postwar economy, diesel fuel rapidly assumed first place. [27] Diesel fuel was planned to be the basic product in major Soviet refineries scheduled for construction after 1958.[28]

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* The term percentage yield denotes percentage of crude oil charge.

TABLE 3-42

ESTIMATED REFINERY YIELDS (WEIGHT PERCENT) FROM NATURAL CRUDE OIL IN THE USSR
1955, 1958-60, AND 1965

	1955		1958		1959		1960		1965	
	MILLION METRIC TONS	REFINING YIELD (PERCENT)	MILLION METRIC TONS	REFINING YIELD (PERCENT)	MILLION METRIC TONS	REFINING YIELD (PERCENT)	MILLION METRIC TONS	REFINING YIELD (PERCENT)	MILLION METRIC TONS	REFINING YIELD (PERCENT)
NEW SUPPLY OF NATURAL CRUDE OIL										
Indigenous production a/	70.8	-	113.2	-	129.6	-	148.0	-	265.0	-
Imports b/	0.0	-	0.1	-	0.0	-	0.0	-	0.0	-
TOTAL	70.8	-	113.3	-	129.6	-	148.0	-	265.0	-
DISPOSITION OF NATURAL CRUDE OIL										
Refinery charge c/	68.4	-	104.0	-	116.0	-	130.0	-	214.0	-
To loss, storage, direct use	0.9 d/	-	1.2 c/	-	2.2 c/	-	1.3 c/d/	-	4.0 c/	-
Exports b/	1.5	-	8.1	-	11.4	-	16.7	-	47.0 d/	-
TOTAL	70.8	-	113.3	-	129.6	-	148.0	-	265.0	-
REFINING OF NATURAL CRUDE OIL c/										
Gasoline	18.0	26.3	22.5	21.6	24.1	20.8	26.0	20.0	35.4	16.5
Kerosene e/	9.7	14.2	12.5	12.0	13.8	11.9	15.3	11.8	24.0	11.2
Light Diesel Fuel	8.6	12.6	21.2	20.4	22.6	19.5	24.2	18.6	31.8	14.9
Heavy Diesel Fuel f/	1.6	2.3	3.5	3.4	4.2	3.6	4.9	3.8	11.2	5.2
Lubricant Base Oils	2.7	4.0	4.6	4.4	5.0	4.3	5.5	4.2	7.9	3.7
Residual and Other Products d/	22.3	32.6	31.4	30.2	37.0	31.9	43.7	33.6	86.7	40.5
TOTAL NONGAS PRODUCTS	62.9	92.0	95.7	92.0	106.7	92.0	119.6	92.0	197.0	92.0
Refinery Gas and Loss g/	5.5	8.0	8.3	8.0	9.3	8.0	10.4	8.0	17.0	8.0
TOTAL REFINERY CHARGE	68.4	100.0	104.0	100.0	116.0	100.0	130.0	100.0	214.0	100.0

a/ 1955 20/
1958-59 21/
1960 22/
1965 Estimated on the basis of past average annual rates of growth and tonnage increments.

b/ 1958-1960 Derived from data pertaining to trade in crude oil contained in 23/.
1955-1960 Estimate based on tanker shipments from the USSR through the Bosporus to the Free World, and imports from the USSR as reported by the satellite nations. Figures reported for 1955 would indicate net export of 2.3 million tons, but on the basis of other information available this appears too high. 24/

c/ See Appendix A, Refining Methodology.

d/ Computed as a residual.

e/ Includes production of 0.4 million tons of ligroine (kerosine-type tractor fuel) in 1955. This estimate is equal to one-third of the estimated consumption of 1.2 million tons of ligroine in 1955. The rest of the ligroine consumed probably came from storage stock accumulated before 1955. Ligroine production was insignificant in the later years.

f/ The heavy diesel fuel contains some residual fuel which is not properly a distillate.

g/ Refinery gas yield was as high as 5 percent in typical major Soviet refineries in 1955-56. 25/ Refinery loss also represented about 4 percent of the crude oil charge in 1956. 26/ On this basis refinery gas and loss has been estimated at a constant 8 percent of the crude oil charge.

With the limited use of the passenger automobile in the USSR, the demand for gasoline has been relatively limited.

At the beginning of the Seven Year Plan in the USSR, the secondary refining facilities necessary for achieving the desired proportions and qualities in the product-mix were relatively scarce. The planned increase of 370 percent in catalytic cracking capacity 29/ probably is designed primarily to achieve the desired increase in diesel fuel production, although an improvement in the quality of the gasoline will be a concomitant result.

There is evidence that Soviet use of cracking always has sought to maximize yields of cracked intermediate distillates,* rather than cracked gasoline as is the practice in the U.S. As of 1960, the Soviet production of gasoline represented about 20 percent (by weight) or roughly one-half of the corresponding percentage in the U.S. In the later postwar period 30/ more gasoline has been produced than could be efficiently used, whereas the reverse has been true in output of diesel fuel, especially light diesel fuel.

According to plans 31/ stated in 1960, there is to be increased blending of excess low-quality straight-run gasoline** with light diesel fuel, in order to increase the output of the diesel fuel, reduce the potential excess in the gasoline production and also to lower the freezing point of the diesel fuel 33/ for frigid weather service. Intensified Soviet interest in the multifuel compression-ignition engine, 34/ as a means of solving the problem of the relative shortage of diesel fuels, was evident in 1960.

By diversion 35/ of the extremely low-quality straight-run gasoline from gasoline end-use, the ratio of cracked gasoline to straight-run gasolines is being increased in the motor gasoline blend, providing higher octane ratings.

The proportion of high-quality conversion stock in the motor gasoline presumably is being increased not only by increase in the proportion of cracked gasoline, but also by

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* Kerosene and diesel fuels.
** Principally contained 32/ in Urals-Volga crude oil.

relatively more reforming of the virgin fraction actually used. 36/ Expanded use of catalytic hydrotreating is proposed for effective desulfurization of the distillate fuels, most of which have been high in fixed sulfur. 37/

Planned improvement in the Soviet motor gasoline mix of 1959-65 is illustrated by the following tabulation:

MOTOR GASOLINES IN THE USSR 38/

GRADE OF MOTOR GASOLINE	MOTOR OCTANE RATING: MINIMUM OCTANE NUMBER	MOTOR OCTANE RATING: TYPE OF MIX	PERCENT OF TOTAL OUTPUT: IN 1959	PERCENT OF TOTAL OUTPUT: PLAN 1965
A-72	72	Clear	2.2	40.0
A-70	70	Leaded	2.5	58.6
A-66	66	Leaded	75.2)	
			)	1.4
Civilian	56-60	Leaded	20.1	

The new Soviet premium grade A-72 of motor gasoline appears to be about equivalent to the regular grade U.S. motor gasoline of 1950 before leading.

c. Production of Lubricant Base Oils*

Production capacity in lubricant processing facilities is to be doubled during the Seven Year Plan. It is estimated that the output of lubricant base oils in the USSR in 1958 was 4.6 million tons, representing 4.4 percent of the total crude oil charge; the output planned for 1965 is estimated as 7.9 million tons, representing 3.7 percent of the total crude oil charge. In the U.S. the output of 7.3 million tons in 1958 constituted only 1.9 percent of the total charge.

In the USSR, high requirements for lubricants relative to the annual quantities of crude oil charge generally have necessitated recovery of practically all of the lubricant stock actually available in the total charge, and the required processing facilities have been costly. In general, lubricant processing facilities involve much more construction cost per unit of output than do other petroleum refining facilities.

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* Products generally derived from crude oil only as straight-run or virgin material.

The relative cost for lubricant processing facilities is increased when it becomes necessary to recover and process poor quality stock. Particular difficulties are involved 39/ in recovering the limited virgin lubricant oil fraction contained in the Urals-Volga crude, which is a mixed paraffin/asphalt base.

E. Type and Location of Expansion

1. Standard Design Refineries

To process the available crude oil into the type and quality of refined products desired and to overcome past construction times, the Soviet planners have standardized the design of their refineries. New capacity is being added in completely integrated standard refineries including primary facilities together with all attendant secondary facilities and supplementary plant installations. 40/ Two sizes of standard refinery have been developed. The smaller one, which features all fundamental operations of processing in single units, has an annual crude oil charge capacity of about 2.3 million tons. This capacity apparently is expanded in practice to 2.6 million tons. Most current construction, however, is of a larger standard design with a crude oil charge capacity cited as 6 million tons, 41/ (but apparently expanded in practice to 6.6 million tons). 42/ Such a standard refinery would have three 2 million ton or two 3 million ton distillation units. In a few cases larger refineries are constructed by adding units in parallel to approximately double or treble the standard design. The large refinery at Omsk, for example, evidently incorporates essential facilities of 3 of the standard design plants, each with a capacity rating of about 6 million tons, for a total estimated capacity of 18.9 million tons. Similarly, the installation at Angarsk is indicated as a single 12.6 million ton capacity refinery, incorporating essential facilities of 2 of the standard design plants, each with a nominal 6 million ton capacity rating.* Such standard design refineries permit more uniform planning of financing and

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* Proposals also have been made 43/ for standard integral refineries having nominal annual crude oil charge ratings of 12 and even 18 million tons. The standard design for a future refinery with the rating of 12 million tons was selected as optimum and apparently finalized by 1960. 44/

construction, improvement of management and labor skills, more accurate estimation of the quantity and probable timing of requirements for materials, and the prefabrication of items of equipment.

Refinery design institutes have developed standardized types of refining process schemes depending on the type of crude available. Crude oils are divided into 3 general categories, with a process arrangement for each:

Type I - <u>Crude Oil under 1.9 percent sulfur (producing both fuels and lubes)</u> - Atmospheric and Vacuum Primary Distillation; Thermal Cracking; Catalytic Cracking; Catalytic Reforming; Lube Oil Production; Asphalt Production (from lube plant).

Type II - <u>Crude Oil under 1.9 percent sulfur (fuels only)</u> - Atmospheric and Vacuum Primary Distillation; Thermal Cracking; Catalytic Cracking; Catalytic Reforming.

Type III - <u>Crude Oil over 2.0 percent sulfur</u> - Atmospheric Distillation

When the American Oil Delegation visited the USSR in August, 1960, sufficient data was obtained on the refineries visited to permit the construction of rather complete flow diagrams. These refineries, their size and the figure number for the flow diagrams are as follows:

REFINERY	DATE CONSTRUCTION COMPLETED	SIZE MMT/Y*	1,000 B/CD	FLOW DIAGRAM FIGURE NUMBER
Novo-Kuybyshev	1951	15	300	5
Novo-Ufa	1951/56	11.5	230	6
Novo-Baku	1953	3	60	7
Syzran'	1942	7	140	8

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* Million Metric Tons Per Year.

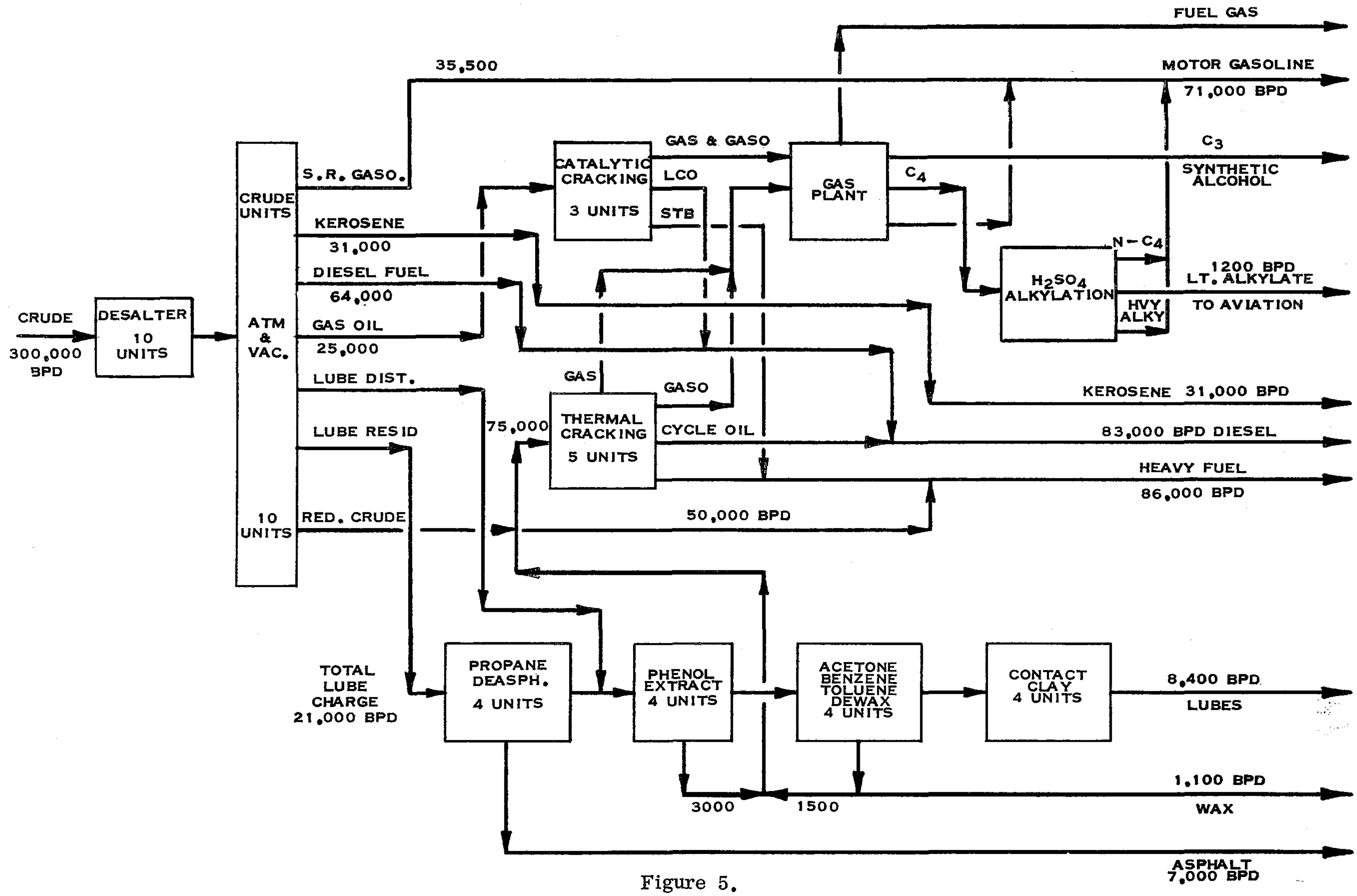

Figure 5.

NOVO-KUYBYSHEV REFINERY

Process Flow Diagram

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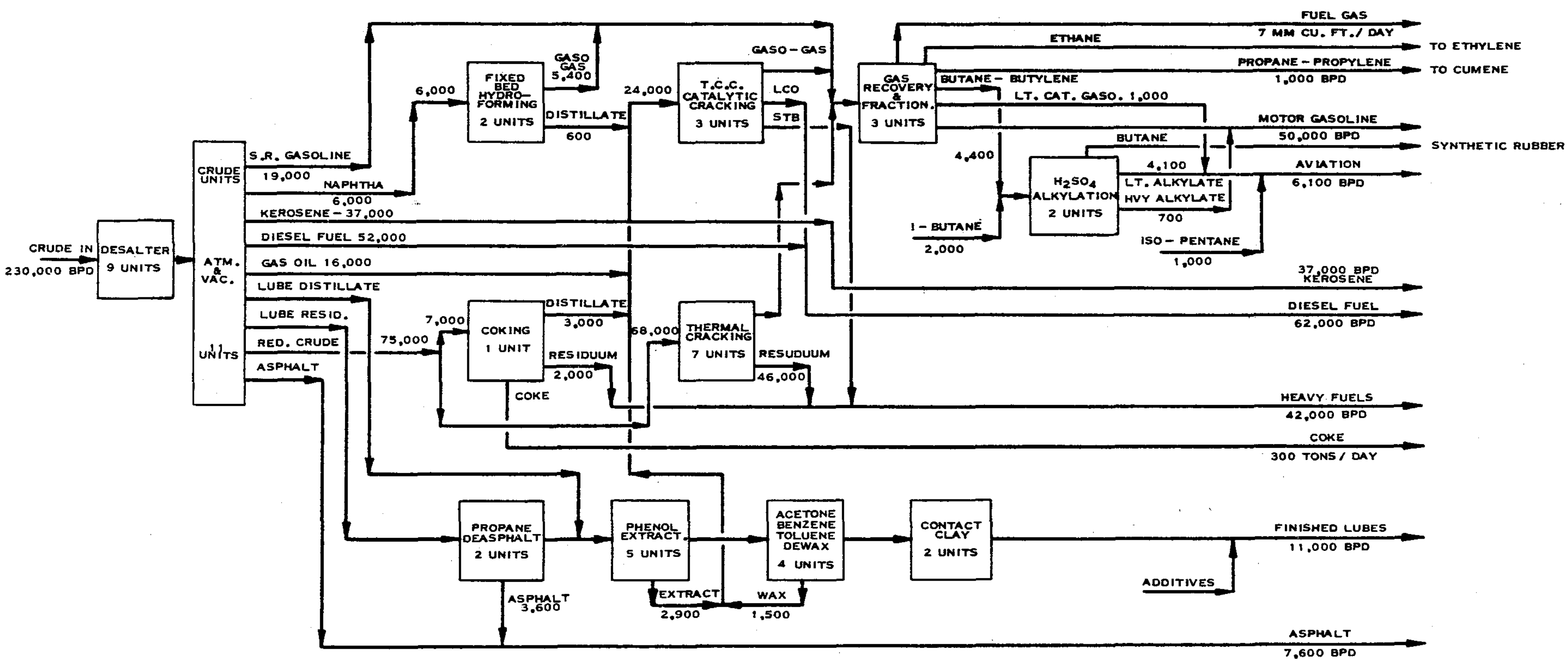

Figure 6.

NOVO-UFA REFINERY
Barrels Per Day
Process Flow Diagram

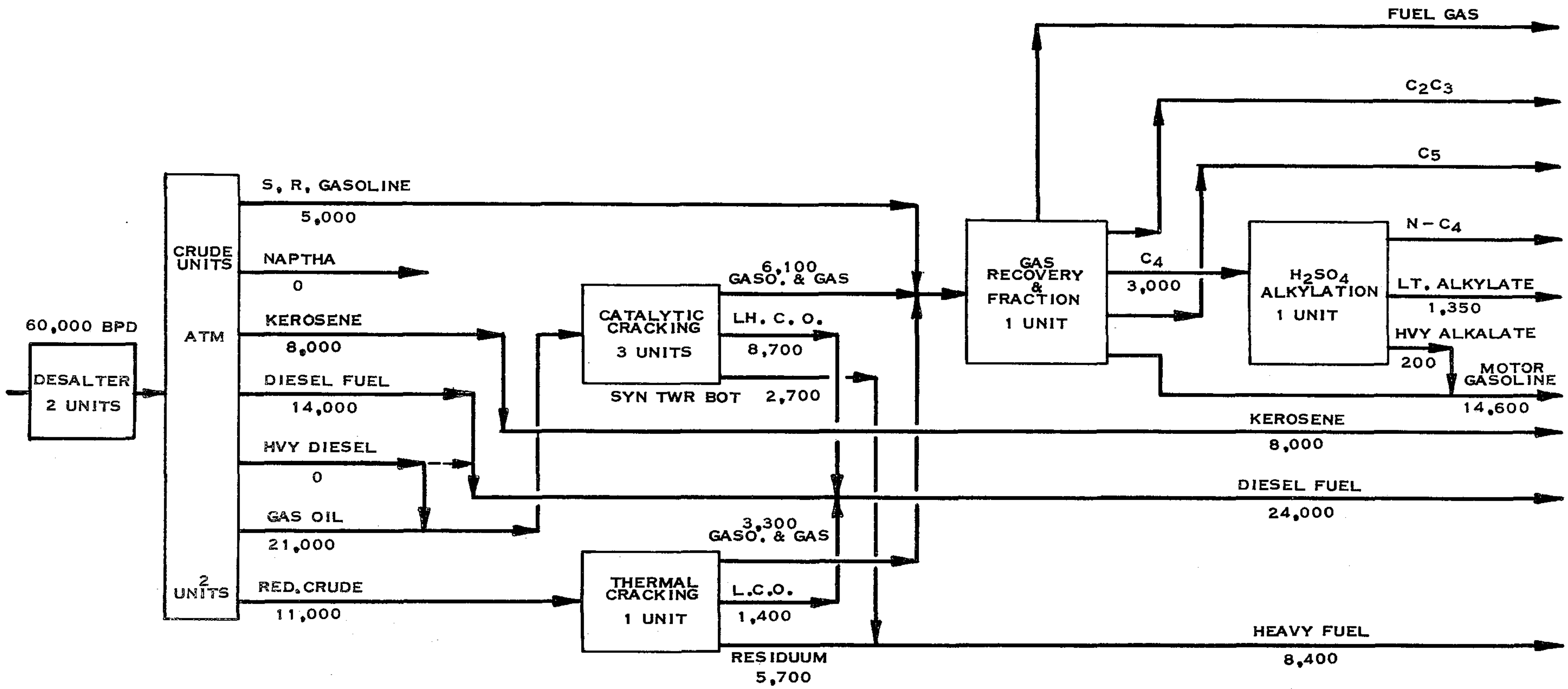

Figure 7.

NOVO-BAKINSKY REFINERY

Barrels Per Day

Process Flow Diagram

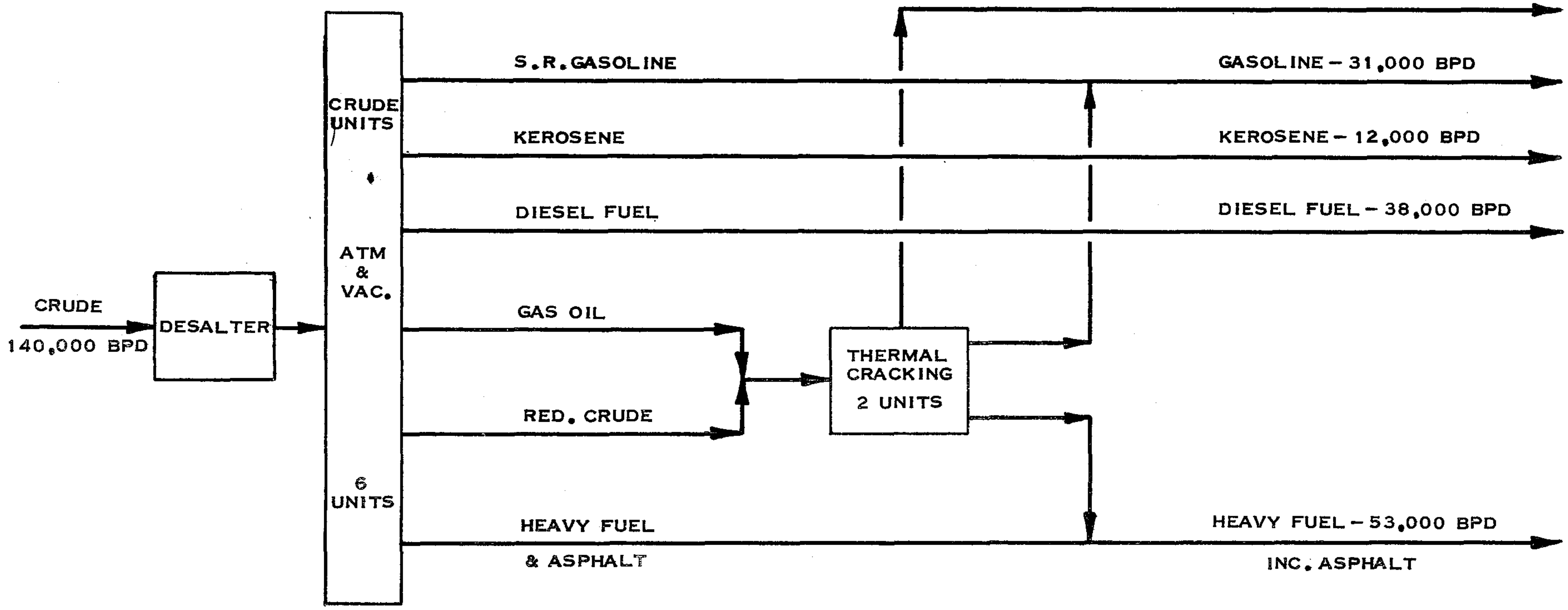

Figure 8.

SYZRAN REFINERY
Process Flow Diagram

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It will be noted that Novo-Kuybyshev and Novo-Ufa are large complete refineries of Type I. Novo-Baku is of Type II, and although Syzran' was a simpler refinery and had no catalytic cracking in operation, one was being constructed. Hence this latter refinery would also be a Type II of Soviet generalized types.

2. Postwar Construction

Certainly the major portion of the new construction that is to occur during the Seven Year Plan, whether at new refineries not in operation in 1958 or at old refineries which then had a substantial portion of their facilities in operation, will occur in the refineries constructed since World War II.

By the close of 1960, postwar constructions had occurred in 19 separate refineries located at 16 separate sites. Table 3-43 shows that initial operation had occurred in portions of 15 of the 19 refineries by the beginning of 1961, and that in 2 of the plants initial operation took place in 1960 - Angarsk in August 45/ and Ryazan' in October. 46/ Estimated service capacities are indicated in Table 3-42 for all 19 of the new refineries.

It is not improbable that some postwar construction in the USSR has been on new refineries in addition to those identified in Table 3-43. Probably small in capacity, these other new refineries appear to be closely integrated with old refineries, most of which have been expanded in capacity during the postwar period. Only the separate new refineries of major importance are listed in Table 3-43.

According to the current estimates, the annual primary service capacity in the 15 major new refineries in operation in 1960 represented nearly 54 percent of the national total and about 62.5 percent of the 134.9 million tons of new annual capacity of the primary type which has been developed since 1945.

The share of the Urals-Volga and the Caucasus in the total refining capacity of the USSR will be reduced significantly during the Seven Year Plan, from more than 75 percent in 1958 to about 51 percent by 1965, although sizeable absolute increments in refining capacity in each of these areas have been planned. This relative decline will derive from the construction of new refineries in such areas as the Baltic,

TABLE 3-43

MAJOR SOVIET REFINERIES UNDER CONSTRUCTION SINCE 1945 a/

REFINERY b/	REPORTED OR PROBABLE DATES: INITIAL CONSTRUCTION d/	REPORTED OR PROBABLE DATES: INITIAL OPERATION e/	APPARENT CONSTRUCTION STATUS BASIS 1960 f/	ESTIMATED CAPACITIES (MILLION METRIC TONS) 1955	1960	FINAL g/
Novo-Baku	1948	1952/1953	Moderate Expansion	2.0	3.0	4.0
Kuybyshev No. 2	1947	1950	Major Expansion	2.8	15.0	25.0
Original Novo-Kuybyshev	1948	1950	Major Expansion	4.7	None	None
Novo-Ufa	1948 h/	1951	Major Expansion	4.8	11.5	12.5
Chernilovsk	1950	1955	Major Expansion	1.0	3.5	12.5
Syzran'	Before 1946	1946 i/	Final Construction	7.0	7.0	7.0
Salavat	Before 1946	1954	Incidental Expansion	3.0	3.1	3.2
Novo-Ishimbay	1953	1955	Final Construction	2.0	2.6	2.6
Novo-Gor'kiy	Early 1951	July 1958	Final Construction	None	2.6	2.6
Omsk	Late 1949	August 1955	Under Construction	2.5	16.0	18.9
Stalingrad	1946	Fall 1957	Advanced Construction	None	5.0	6.6
Perm'	Spring 1951	November 1958	Under Construction	None	5.0	6.6
Fergana	1949	September 1958	Under Construction	None	5.0	6.6
Novo-Yaroslavl	1953	After 1960	Under Construction	None	None	6.6
Ryazan'	1952	October 1960	Under Construction	None	1.0	6.6
Angarak c/	Early 1954	August 1960	Under Construction	None	4.0	12.6
Kritovo	1958	After 1960	Under Construction	None	None	2.6
Pavlodar	1958	After 1960	Under Construction	None	None	6.6
Polotsk	1958	After 1960	Under Construction	None	None	6.6
TOTAL				29.8	84.3	149.7

a/ Does not include refineries which provided any significant output before 1946.

b/ "New" refineries are represented by the 19 plants listed. Except at Baku, Kuybyshev, and Ufa, the "new" refineries are located at "new" sites in the sense that no major refineries existed at the sites before the postwar period. Postwar major status is shown for prewar minor "old" refineries in 2 of the 3 "new" sites that contained minor "old" refineries.

c/ The so-called "eastern" refinery, sometimes designated as the Irkutsk refinery.

d/ Soviet reports indicate that site preparatory work actually was stated in 1956 at Kritovo and Pavlodar, and in 1957 at Polotsk.

e/ These initial operations before 1961 were attained invariably in plants still in states of partial completion. In all instances, primary distillation facilities predominated in the portions initially commissioned on stream. In most of the plants, the initially operating capacities were relatively small.

f/ Official reports specify or imply a planned completion date of no later than 1965 for all constructions and expansions here shown to be in progress in 1960.

g/ Except at Baku, Kuybyshev, Ufa, Syzran', and Salavat, these final capacities probably are represented in standardized Soviet plants. The standard design with the 6.6 capacity rating appears to be preferred in current constructions. Nevertheless, a smaller standard design is indicated at some new plants. As officially reported, the smaller design features all fundamental operations of processing in single units; it develops a service capacity for annual charge of crude oil equal to about 2.3 million tons, apparently expanded in practice to 2.6 million tons, corresponding to 55,000 barrels per stream day. In Syzran' and Salavat Constructions, where the stage of work was more advanced at an earlier date than in the other 12 new refineries at new sites, final capacities apparently approximate standard design, even though standard design was not applied. The evidently enormous Omsk installation is indicated as a single refinery, incorporating 3 of the standard plan designs with the 6.6 capacity rating. The Angarsk installation also is indicated as a single refinery, incorporating 2 of the standard plant designs with the 6.6 capacity rating.

h/ Onsite construction of actual process facilities at Novo-Ufa was initiated in 1949.

i/ The nucleus of the Syzran' refinery was of later prewar construction, brought on stream in 1942 during war time, presumably on an emergency basis. Soviet data, however, at least imply that normal service capacity was not attained in the plant until the beginning of the post-war period.

the Ukrainian SSR, Kazakhstan and Central Asia and Siberia, where prior to the Seven Year Plan there was little, if any, refining capacity available.

F. Prospects for Plan Fulfillment

1. Past Construction Record

a. Construction Time and Cost

The time required for construction of refineries in the USSR has been excessive when compared with the time required for similar construction in the West. Until the beginning of the Seven Year Plan, the time norm established for complete construction of a standard-design refinery with a crude oil charge capacity of 6 million tons was 7.5 years. [47] Nevertheless, the time norm has been considerably exceeded, or will be considerably exceeded, in the construction of nearly every major new refinery commenced during the period 1949-54. A critical Soviet statement early in 1958 indicated 10 to 15 years as the realistic period then in prospect for the work supposed to be done within the norm time. A lapsed time of 14 years is indicated in some of the actual projects. In Western practices, the construction covered by the Soviet norm of 7.5 years probably would be completed within 2 to 3 years.

In discussing the low levels of attainment in refinery construction, official complaints indicate the principal causes as inefficient management and financing, insufficient supplies of equipment and material, and inadequate construction capabilities and procedures in the physical installations. The petroleum industry has had to compete with other industries, especially the chemical industry, for certain types of managerial and labor skills, and for certain materials and prefabricated items of equipment. There have been delays [48] in financing. For example, the construction time norm of 7.5 years reportedly [49] was based on an on-site application during the first year of construction, of about 15 percent of the total monetary cost of a new refinery. Official reports indicate that in postwar construction of major new refineries, the actual allocation for the first year seldom exceeded 6 percent, and frequently has been less than 1 percent. It is possible, of course, that some of the delay in allocation of investment may have been symptomatic rather than a cause of the delay in construction.

There is evidence that when increased requirements for new refining capacity or technological improvements developed during the course of construction, the Soviets have redesigned facilities before putting them into service. Long construction times, coupled with rapid technological progress in the natural crude oil refining industry, have tended to render obsolete much of the equipment before it ever goes on stream. A notable example of redesigning while construction was still underway was the general engineering revision of 1956 50/ which probably applied to major new refineries then under construction in Angarsk, Perm', Ryazan', Yaroslavl', Omsk, Stalingrad, and Fergana.

In Soviet refinery construction since 1950, total capabilities and effort have been dispersed over many major projects. There was a tendency, until shortly before the beginning of the Seven Year Plan, to publicize this multiplicity of concurrent projects as an indication of industrial progress. More recently, however, official statements 51/ have declared that the dispersal of efforts has been excessive and much in error.

b. Quality of Construction - Balance Between Facilities

Poor quality of construction and imbalances in the development of different types of facilities also have been a part of the past record of refining construction. Impromptu planning, haphazard progress in construction, and inefficient construction practices have resulted in poor quality construction and a series of piecemeal completions. The rapidly increasing availability of crude oil has compelled emphasis on the completion of primary capacity for crude oil distillation, 52/ often at the expense of planned increases in the secondary refining facilities essential for improving the quality of Soviet petroleum products. In most of the major refinery projects under construction in 1960, the share of monetary investment accounted for by primary facilities then in place apparently was much higher than the share of those facilities in total investment commitments for the complete refineries. Although highly efficient facilities of modern design undoubtedly exist at a number of sites, there is good evidence that the national complex of refineries have the general semblance of a make-shift assemblage of equipment. The American Petroleum Delegation which visited the USSR in August, 1960, confirmed this. The refineries visited were characterized by extremely poor construction, maintenance and housekeeping standards.

Much of the equipment lacked paint. The insulation and weatherproofing were disintegrating and steam leaks from valves and gaskets were abundant. In the insulation of a hot line, the first step was to wire on a brick measuring 4" x 6", followed by plaster over the brick. Product piping is laid in concrete trenches about one to two feet deep, then covered with concrete slabs about 18" wide, 3 feet long, and 3" thick. These irregular slabs had two lifting hooks at either end. This method results in a very irregular trench covering which presents a considerable safety hazard. At the Syzran' refinery, the trenches had been filled with sand as a safety precaution.

Almost all of the control houses had broken windows and in a heavy rain leakage around the windows and through the roof joints was clearly evident. Some of the control houses had curtains at the window and were decorated with large house plants.

Many simplex and duplex reciprocating pumps were used. Brass valves were used on the pumpout lines from the pumps--even on those pumps in hot service. Nearly all of the pumps were steam driven and some plants were venting large quantities of excess steam. The control instruments were all air actuated. Virtually all of the plants were equipped with the large scale old type recorders and controls. There was no explosion-proof equipment in the control houses.

The fire protection at these refineries was well below U.S. standards. There were a few hand extinguishers in evidence and no high pressure water or fixed foam systems. None of the supporting steel structures were insulated for fire. Boxes of sand and shovels were located around the units and in the laboratories. It was stated that fires were fought with steam, CO_2 and portable foam. However, there was no indication of fire damage in the refineries visited.

Safety standards paralleled those of fire protection. The workers do not wear hard hats except when inside a chamber doing repair work, nor were hard toe safety shoes worn. There were no goggles or safety showers at the sulfuric acid alkylation units. The absence of these protective measures, combined with low piping, uneven stairways, irregular covered trenches and uneven steel floor plates on the structure, would be expected to result in a high accident incidence. Nevertheless, it was claimed that the safety record was satisfactory.

The refineries are spaciously laid out. There is a normal allowance of 100 meters between gas units, 200 meters between units and storage, and 40 meters between other units. It appeared that most of these standards were exceeded, thus adding to the capital and operational costs incurred by the wide spacing.

The delegation observed, however, that the construction standards being employed at 2 refineries undergoing expansion in August, 1960--Syzran' and Novo-Kuybyshev--showed a vast improvement over earlier construction.

2. <u>Achievements 1959-60</u>

a. Additions to Capacity

By 1960, the service capacity of Soviet crude oil refineries is estimated to have risen to 157.3 million tons, 31 percent above the estimated service capacity of 1958. The crude oil charge to refining in 1960 is estimated as 130 million tons or 1.25 times the 1958 charge of 104 million tons. This increase in capacity of about 37 million tons in two years is equal to the average annual increase of about 18.5 million tons that would be required if the estimated goal of 250 million tons is to be achieved.

b. Construction of New Facilities

There is evidence that in the construction of new refining facilities during 1959-60 the USSR attempted to correct the past dissipation of effort over an excessive number of projects. It has concentrated construction on a relatively small number of projects. Most important, there is no evidence of the start of construction on any major new refinery during 1959-60 in the USSR. Construction activities may have been maximized in the 16 refineries that were in advanced stages of construction in 1960, and minimized in the refineries at Kritovo, Pavlodar, and Polotsk, where construction was not initiated until 1958. At least there are no known Soviet reports indicating particularly significant progress in construction at those 3 sites in 1960. Although the typical postwar practice was duplicated, in that the new Angarsk and Ryazan' refineries were belatedly brought on stream in states of partial completion in 1960, there is evidence that construction was being intensified for completion in the latter part of 1960 and early part of 1961, not only in those 2 refineries, but also in the other uncompleted new refineries where construction has been in progress for 6 years or more.

At Angarsk, for example: an atmospheric-vacuum combination distillation unit was being completed in October, 1960, [53] to increase the service capacity for crude oil charge 1.5 times; a second integral part was under intensified construction in December; [54] and in January, 1961, plans for construction of a 50 kilometer transmission gas pipeline for transport of Angarsk refinery gas to Irkutsk were being discussed. [55] Late in October, 1960, the trunk oil pipeline from the Urals-Volga oil fields had already reached Ryazan'; and it was to be completed by November, 1960, along the trace Al'met'yevsk-Gor'kiy-ryazan'. [56] In late 1960 and early 1961, construction work was being accelerated in refineries at Ryazan' [57], Stalingrad [58], Perm' [59], and Omsk [60]. Both the Novo-Yaroslavl' [61] and Fergana [62] refineries are priority projects for 1961. In November, 1960, new construction and further modernizations also were in progress in the refineries at Kuybyshev and Syzran'. [63] The Kuybyshev refinery had already attained the planned 1965 level for output of principal light products.

c. Relationship of Primary Distillation and Secondary Facilities

Table 3-44 shows a possible breakdown for the primary and secondary service capacities developed in all Soviet natural crude oil refineries; the data compare capacities in 1950, 1955, 1958-60, and the prospects for 1965.

It is not certain, however, that the refining capacity available in 1965 will be exactly of the type desired. As indicated previously, steps are being taken to reduce the need for secondary refining capacity by blending excess straight-run gasoline with light diesel fuel and by increasing industrial consumption of residual fuel oil. The program for constructing integrated standard design refineries aims, in part, at developing a balance between primary and secondary facilities. In spite of these facts, it is possible that the pressure for expansion of primary capacity to handle the increasing availability of crude oil will result in some imbalance of facilities. Although Soviet literature indicates that notable gains have been achieved in secondary refining, especially in thermal conversion, catalytic cracking, and catalytic hydrotreating processes, total secondary refining capacity probably still is below the level desired, particularly for the production of

TABLE 3-44

ESTIMATED ANNUAL SERVICE CAPACITIES IN SOVIET NATURAL CRUDE OIL REFINERIES a/
1950, 1955, 1958-60, AND 1965 PLAN

OPERATION IN SYSTEM	1950 MILLION METRIC TONS	1955 MILLION METRIC TONS	1958 MILLION METRIC TONS	1959 MILLION METRIC TONS	1960 MILLION METRIC TONS	1965 MILLION METRIC TONS
Thermal conversion b/ c/	NA	18.5	24.5	27.5	31.5	50.4
Catalytic cracking b/	NA	9.1	12.0	16.3	22.0	56.4
Subtotal b/ c/	12.7	27.6	36.5	43.8	53.5	106.8
Catalytic reforming b/	0.0	0.0	1.0	2.9	5.4	17.0
Catalytic hydro-treating b/	0.0	0.0	1.0	5.9	12.4	43.0
Lubricant processing d/	2.2	3.5	5.4	6.2	7.0	10.8
Atmospheric distillation b/ e/	47.1	89.5	122.3	137.4	157.3	252.0

a/ The derivation of estimates of primary distillation capacity is described in Appendix A, Methodology, pages 164-167.

b/ Charge capacity.

c/ Principally the reduction operations of true cracking, visbreaking, and coking. True thermal reforming possible but negligible in the ratings shown.

d/ Production capacity in lubricant base oils.

e/ Primary refining of crude oil charge.
Combination atmospheric-vacuum distillation units are typical in postwar constructions.
Data not available for capacities in the secondary refining represented by vacuum distillation.

diesel fuels which were reported to be in short supply in 1960. It is probable that more emphasis will have to be placed on the construction and installation of secondary refining facilities if the qualities and proportions apparently desired for the product mix in 1965 are to be achieved.

3. Possible Effect of Failure to Meet Plan

Clearly one possible effect of failure to achieve a refining capacity of 250 million tons by 1965 would be a change in the pattern of Soviet exports of petroleum. With an estimated production of 265 million tons of crude oil in 1965, loss, storage, and direct use may be expected to account for about 4 million tons. Operation of 250 million tons of refining capacity at about 85 percent would require a crude oil charge of 214 million tons, and about 47 million tons of crude oil would be available for export. The yield of nongas products would be about 197 million tons. (See Table 3-42) With a domestic consumption of 180 million tons of products, 17 million tons of products would be available for export. To this availability for export must be added approximately 5 million tons of products--equivalent to the estimated production of synthetic products and liquified petroleum gas. These 22 million tons of products available for export are equivalent to about 23 million tons of crude oil. Thus in 1965 the USSR would be able to export (net) about 70 million tons of crude oil equivalent, of which at least two-thirds would be in the form of crude oil. (Soviet exports of petroleum in 1961 were about 60 percent crude).

It will be noted that in the section of this report dealing with petroleum trade, an independent estimate of 22 million tons of petroleum product exports for 1965 was obtained from an analysis, by regions and countries, of past trends, demand patterns, trade agreements and facilities for handling Soviet Bloc crude and products.

Should the refinery construction goal not be attained, as indicated previously, domestic requirements for petroleum products could still be satisfied with a crude oil charge of only 196 million tons. In this case the availability for export in the form of crude oil would be about 65 million tons, to which could still be added the 5 million tons of products equivalent to production of synthetics and liquefied petroleum gas. It is doubtful, however, that any such extreme situation would develop as refining capacity almost certainly will exceed the minimum of 230 million tons required to process a crude oil charge of 196 million tons and produce 180 million tons of products while operating at 85 percent. Even if it did not, the product yield could still be increased by increased utilization of facilities. Depending, of course, on the relative market opportunities for crude oil, and petroleum products, it is much more likely that of an estimated net export capability of 70 million tons from two-thirds to three-quarters will be crude oil and one-third to one-quarter petroleum products.

G. Costs of Refinery Construction

It is estimated that the Soviet Union plans to invest about 3.6 billion rubles in petroleum refining facilities during the Seven Year Plan.* This figure can be divided roughly as 3.0 billion rubles for construction of new refineries and 0.6 billion rubles for expansion and modernization of facilities operating in 1958. Until the general engineering revisions of early 1956 the prevailing unit construction costs for a completely integrated refinery, including primary and all attendant secondary facilities, was about 44.2 rubles per ton of crude charge capacity. The engineering revisions and standardization of design apparently have reduced this cost substantially. The capital expenditure for constructing a standard design refinery equivalent to the Ryazan' plant (6.6 million tons of primary distillation capacity) was reported in 1956 as 34.3 rubles per ton of primary capacity. 64/ For standard refineries, much simplified in comparison to the Ryazan' pattern, a corresponding rate of expenditure was cited in 1960 as 29.0 rubles, if the annual primary capacity was 6 million tons. 65/ It also was reported that if capacity were doubled, the capital expenditure per ton would be reduced to 21.0 rubles; and, if capacity were trebled, to 19.5 rubles per ton. During the Seven Year Plan approximately 8.9 million tons are to be added at Omsk, the total capacity of which is to be roughly three times that of the larger standard design refinery, and 12.6 million tons are to be constructed at Angarsk. Nearly 43 million tons of capacity are to be added during the Seven Year Plan in refineries of the 6.6 million ton type which already are under construction. If it is assumed that the 25 million tons to be added in refineries not yet under construction in 1960 are all to be added in standard design refineries having a capacity of 6.6 million tons, approximately 68 million tons

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* For the derivation of this estimate see Appendix A, Refining Methodology.

will be added in that type facility. Two smaller standard refineries, Novo-Gor'kiy and Kritovo will add 5.2 million tons. Unfortunately no official unit cost data for refineries of this size are available. Nevertheless, the above information makes it possible to estimate that investment in construction of refinery capacity during the Seven Year Plan may be divided roughly as follows:

FACILITY	CAPACITY TO BE ADDED (MILLION METRIC TONS)	UNIT COST (RUBLES)	INVESTMENT (BILLION RUBLES)
Omsk	8.9	19.5	0.17
Angarsk	12.6	21.0	0.26
New Construction of Refineries of 6.6 Million Tons Capacity	68.0	34.3	2.33
New Construction of Refineries of 2.6 Million Tons Capacity	5.2	46.1 a/	0.24 b/
TOTAL CONSTRUCTION IN NEW REFINERIES	94.7	31.7 a/	3.00
Expansion and Modernization of Old Refineries	35.0	17.1 a/	0.60
TOTAL	129.7 c/	27.8 a/	3.60

a/ Calculated on the basis of capacity to be added and investment.
b/ Residual derived on the basis of a rough division of estimated total investment in construction of refining capacity.
c/ The difference between an estimated service capacity of 122.3 million tons in 1958 and 252 million tons in 1965.

Thus, of the approximately 130 million tons of refining capacity to be added during the Seven Year Plan about 95 million tons of construction in new refineries may be accomplished with an investment of about 3.0 billion rubles. The unit cost shown in the above tabulation for the two refineries having capacities of 2.6 million tons was derived as a residual.

Conceivably the unit cost of such construction might be nearer the 44.2 rubles per ton which prevailed prior to the engineering reforms. On this basis the average unit cost for the new construction may be somewhat imprecisely estimated at 31.5-32.0 rubles per ton, and the unit cost for expansion and modernization of facilities existing in 1958 at 17-18 rubles per ton.

The value of 31.5-32.0 rubles per ton for new construction is equivalent to about $1,750 per barrel per day capacity, and 17.0-18.0 rubles per ton is equivalent to about $1,000 per barrel per day for expansion and modernization. These investments appear unusually high by Western standards. In Europe today, for example, hydroskimming refineries are being constructed with typical yield structures from Aramco crude about as follows:

	WEIGHT PERCENT
Motor Gasoline	19
Distillates	35
Residual	46
	100

This is not substantially different from the average distribution in the Soviet refineries of the future. However, such installations are being made for $400 to $600 investment per barrel per day capacity in new refineries. Even much more complex refineries with substantial conversion equipment are constructed for less than $1,000 per barrel per day, in the size of the standard Soviet refinery (6.6 million tons, or 130,000 barrels per day). Expansion and modernization costs are much less.

Table 3-45 shows the construction costs as planned for Ryazan' refinery in 1957.

TABLE 3-45

PLANNED CONSTRUCTION COSTS FOR THE RYAZAN' REFINERY, 1957

CATEGORY OR SERVICE OF FACILITY	CAPACITY RATING: THOUSAND METRIC TONS PER YEAR	CAPACITY RATING: TYPE OF RATING	CONSTRUCTION COST: RUBLES PER TON OF ANNUAL CAPACITY	CONSTRUCTION COST: TOTAL (MILLIONS OF RUBLES)
Electrolytic Desalting of Crude Oil				
Crude Oil Distillation	6,604 a/	Charge	5.28 b/	34.87 c/
Atmospheric				
Vacuum				
Thermal Cracking	337 d/	Charge	3.48 b/	1.17 c/
Catalytic Cracking	1,209 d/	Charge	11.27 b/	13.63 c/
Thermal Residue Processing	1,116 d/	Charge	10.04 b/	11.20 c/
Visbreaking (mild cracking)				
Coking (destructive cracking)				
Catalytic Alkylation	e/	Production	47.67 b/ f/	31.36 c/
Catalytic Hydrotreating	2,463 d/	Charge		
Basic Production Facilities	6,604 a/	Charge	13.97 c/	92.23 g/
Lubricant Processing	e/	Production	14.23 b/	e/
Asphalt Processing	e/	Production	9.92 b/	e/
Chemical and Physical Treating				
Methyethylkentone Deparaffination of Distillate		Charge	24.04 b/	
Carbonide Deparaffination of Distillate		Charge	10.12 b/	
Other Typical Deparaffination of Distillate		Charge	25.50 b/	
Oil Deasphalting		Charge	4.99 b/	
Wax Deoiling		Production	17.32 b/	
Other				
Special Processing				
Process Pipelines, Blending, and Tankage in the Area				
Water, Air, and Incidental Utility Supply				
Other Service Communications, Transport, Laboratory, etc.				
Miscellaneous Plant Facilities	6,604 a/		16.09 c/	106.24 g/
Electric Power and Steam Supply	6,604 a/		0.95 c/	6.27 g/
Other Production Facilities	6,604 a/		17.04 c/	112.51 e/
And Cultural Facilities	6,604 a/		3.30 c/	21.79 g/
OVER-ALL RYAZAN' REFINERY h/	6,604 a/		34.30 g/	226.53 g/

a/ Derived from data on cost per ton and total cost.
b/ Cited in 66/.
c/ Derived from other data shown.
d/ Derived by application of percentages from source 67/ to the calculated total crude capacity.
e/ Actual plan data for Ryazan' refinery not available. Estimates based on Soviet practices in construction of standard refineries are as follows:

	ESTIMATED PERCENT OF CRUDE CHARGE	THOUSAND METRIC TONS CAPACITY PER YEAR	TYPE OF RATING	RUBLES PER TON OF ANNUAL CAPACITY	TOTAL (MILLIONS OF RUBLES)
Catalytic Alkylation	3	198	Production	47.67	9.44
Catalytic Hydrotreating	17	2,463	Charge	8.90	21.92
Sub-Total					31.36
Lubricant Processing	4	264	Production	142.30	37.57
Asphalt Processing	3	198	Production	9.92	1.96

f/ A unit construction cost of 15.7 rubles per ton was cited for the alkylation unit itself, as distinguished from the facilities for feed preparation and stock recovery in catalytic alkylation.
g/ Cited in source 68/.
h/ It is probable that the Ryazan' refinery will include catalytic reforming facilities. Such facilities are proposed for standard refineries 69/. It is also possible that catalytic hydrocracking units of the Varga type 70/ will be included 71/.

APPENDIX A

REFINING METHODOLOGY

1. Estimates of Soviet Crude Oil Charge Capacity

In 1932 the total crude oil charge capacity in the USSR was 21.4 million tons, and was but slightly less than what was left in 1945 after wartime destruction. 1/ This has been interpreted to mean that a capacity of about 22.4 million tons existed in 1945.

The capacity in 1955 was 4 times as much as in 1945 2/ and was 1.9 times as much as in 1950. 3/ Consequently, the capacity for 1950 has been estimated at 47.1 million tons and that of 1955 at 89.5 million tons.

The capacity in 1960 was planned to be 3.34 times as much as in 1950. 4/ It was assumed that the plan goal was achieved and that capacity in 1960 was 157.3 million tons. Capacities of 122.3 million tons for 1958 and 137.4 million tons for 1959 were estimated by treating the estimated crude oil charge as approximately 85 percent 5/ of capacity. The estimate for 1959 was adjusted on the basis of estimates of capacities at individual sites. Because of the imprecise nature of the data the estimate for 1958 has been rounded to 120 million tons in the textual discussion. Table 3-41 and 3-44 showing the distribution of capacity by facilities show the unrounded figures.

The estimated goal for capacity in 1965 was derived as follows: 6.15 million tons of diesel fuel are to be used in railroad locomotives in 1965. This use by the railroads is to be 14.3 percent of the total production of diesel fuel. 6/ On this basis 43 million tons of diesel fuel are to be produced, of which 26 percent 7/ or 11.2 million tons is to be heavy diesel fuel.

Diesel fuel demand in 1965 is expected to be 42 percent of the demand for light products 8/, where the term "light products" apparently was used to include not only gasoline, kerosene, and light diesel fuel, but heavy diesel fuel as well.* On this basis, the demand for light products in 1965 is 102.4 million tons on the assumption that the relationship between diesel fuel and total light products will be the same for both demand and production, and furthermore, that production of light products will equal demand, results in the 102.4 million tons of light products production shown on Table 3-42.

The demand for kerosine and diesel fuel in the USSR in 1965 is to be 65.4 percent of the total demand for light products and the demand for gasoline is to be 34.6 percent.11/ Assuming the demand for diesel fuel to be equal to production, the production of 102.4 million tons of light products would break down as follows: diesel fuel-43 million tons, kerosine-24 million tons, and gasoline-35.4 million tons.

Other information indicates that the demand for furnace mazut (residual fuel oil) in 1965 will be 67 million tons, 12/ and that the demand for fleet mazut will be 11 million tons (computed from a figure given in standard fuel 13/). The 78 million tons of mazut demand thus accounted for is assumed to be 90 percent of the category "residuals and others" which is estimated at 86.7 million tons for 1965.

The demand for lubricants in the USSR in 1965 is to be 3 times the consumption in 1955. 14/ It is assumed that consumpton of lubricants in 1955 was approximately equal to production. The production of lubricants in 1955 has been estimated at 2.65 million tons on the basis of published link relatives dealing with products and crude oil charge. On this basis the production of lubricants in 1965 has been estimated at 7.9 million tons.

Summation of these estimates of product output derived above indicates a total output of petroleum products of 197 million tons in 1965. In current estimates of Soviet refining operations, a constant of 92 percent of the crude oil charge

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* From the context of 9/ it is evident that heavy diesel fuel was included. Soviet literature, although not entirely consistent, usually includes in light products--gasoline, kerosine, light diesel fuel, and formerly ligroine, but not heavy diesel fuel. 10/ Elsewhere in this report heavy diesel fuel has not been included in light products.

is applied for outputs of the total nongas products, distinguished from refinery gas as a product. Hence the total nongas product outputs and the crude oil charges stand in the same ratios. Dividing the estimated output of 197 million tons of nongas products by 92 percent yields an estimate of crude charge of 214 million tons. Assuming that the USSR plans to continue current practice of operating at about 85 percent of capacity 15/ a crude charge of 214 million tons would indicate refining capacity of 252 million tons in 1965. Because of the imprecise nature of the data this figure has been rounded to 250 million tons.

In deriving this estimate of the goal for refining capacity in 1965 some liberties have been taken in rounding estimates of individual product output so that their summation will result in an estimate of total product output in millions of tons. Given the imprecise nature of the 1945 base and of several other figures used, an attempt to estimate product output, crude charge, or refining capacity more precisely than to the nearest million tons would be unwarranted. A recognized defect in the above methodology is the use of certain demand data in estimating production. For the earlier years, when the trade of the Soviet Union in petroleum was very small and consumption for all purposes was equivalent to production, this defect probably was not serious. Even with respect to deriving the estimate of capacity in 1965, the problems arising from use of consumption data are more theoretical than actual. An estimate of capacity based on consumption data would be a minimal estimate. A larger capacity would be required if the USSR planned to export significant quantities of petroleum products. As analysis contained in the body of the paper indicated that the Soviet Union may not be able to increase its refining capacity to the 250 million tons indicated by data pertaining to product consumption plans, it is even less likely that it could achieve a higher capacity. Consequently, refining capacity in 1965 probably will not greatly exceed that necessary to satisfy domestic demand. Exports of petroleum products in excess of the 22 million tons indicated in the text probably would be at the cost of domestic consumption. The bulk of Soviet exports of petroleum in 1965 probably will be in the form of crude oil.

2. Estimates of Crude Oil Charge to Refining

It has been assumed that the charge to refining in the USSR consists of natural crude oil. The small ratio of the output of natural gas liquids to the output of crude oil and the low quality of the motor gasoline which would contain the major part of the material derived from natural gas liquids indicate that natural gas liquids are of no real importance. The output of shale oil and other synthetic petroleum stock also appears to be negligible.

The charge to refining in 1913 was reported as 5.702 million tons. 16/ In 1955 the charge was 12 times as much as it was in 1913. 17/ Consequently the charge for 1955 has been estimated at 68.4 million tons. This figure affords a basis for several other estimates. Soviet sources provide the following link relatives:

1955/1950 = 1.885 18/

1955/1946 = 3.4 19/ or 3.43 20/

1956/1955 = 1.18 21/

1957/1946 = 4.65 22/

On the basis of these link relatives the following estimates of crude oil charge to refining were derived:

	MILLION METRIC TONS
1946	20.0
1950	36.3
1955	68.4
1956	80.7
1957	93.0

Estimates of the crude oil charge for the years 1958 and 1959, were derived by subtracting from the officially reported crude oil production figures available data on net exports of crude oil and an allowance of approximately 1.5 percent for loss, storage and direct use. (The allowance for loss, storage, and direct use was adjusted to permit rounding the estimated crude oil charge to the nearest million tons. The appearance of greater precision in the estimated crude oil charge would be misleading and the factor for loss, storage, and direct use does, in fact, fluctuate from year to year). The crude oil charge was estimated for 1960 on the assumption of an average annual increase of 12.3 million tons per year in the years 1956-60--the estimated goal of the Sixth Five Year Plan. This increase was actually achieved in 1956 and 1957. Complaints of lags in refinery construction in 1958 and 1959 indicate that the charge fell below the desired average in those years, but by 1960 three refineries which came into operation in the latter part of 1958 probably were operating with sufficient capacity to make up the lag. Loss, storage, and direct use of crude oil in 1960 was estimated as a residual. These data are shown in the following tabulation:

(MILLION METRIC TONS)

YEAR	CRUDE OIL PRODUCTION	NET EXPORTS OF CRUDE OIL	LOSS, STORAGE, AND DIRECT USE	ESTIMATED CRUDE OIL CHARGE
1958	113.2	8.0	1.2	104
1959	129.6	11.4	2.2	116
1960	148.0	16.7	1.3	130

Plans call for a crude oil charge in 1961 that will be 110 percent of that in 1960. 23/ On this basis the planned charge for 1961 would be about 143 million tons. Derivation of the crude oil charge figure for 1965 shown in Table 3-42 has been explained above in connection with the estimates of capacity. It is based on a supposed output of 197 million tons of petroleum products and an allowance of 8 percent of the charge for refinery gas and loss.*

It should perhaps be pointed out that achievement of a crude oil charge of 214 million tons in 1965 would require an average addition of about 17.8 million tons per year of refining capacity during the years 1962-65. This would be considerably greater than the average annual increase of approximately 12.5 million tons for the years 1956-61. Should the average annual tonnage increment remain about as estimated for the years 1956-61, the crude oil charge in 1965 would be

* Loss, storage, and direct use in 1965 was estimated at 1.5 percent of production, and availability for export was calculated as a residual.

only about 195 million tons instead of 214 million. This would require a capacity of 230 million tons, operating at about 85 percent, and would be adequate to supply anticipated domestic demand but would mean that only a small quantity of petroleum products would be available for export.

3. Output of Petroleum Products, 1955

a. Gasoline, Kerosine, Diesel Fuel

Estimates of the output of various petroleum products which are shown in Table 3-42 were derived as follows:

The yield of "light products" (here assumed to include gasoline, kerosine, light diesel fuel, and ligroine) was equal to 42 percent of the crude oil charge in 1946 and 53 percent in 1955. 24/ In 1950 it was double the yield of light products in 1946. 25/ These percentages indicate the following yields of light products (in millions of tons): 1946 - 8.4; 1950 - 16.8; 1955 - 36.3. On the basis of fragmentary data on consumption, ligroine production is estimated to have been as follows: 1946 - 0.8 million tons; 1950 - 1 million tons; 1955 - 0.4 million tons. Thus the combined yield of gasoline, kerosine, and light diesel fuel must have been approximately 7.6 million tons in 1946; 15.8 million tons in 1950; and 35.9 million tons in 1955. The following annual link relatives were available for estimating the output of these products:

	ANNUAL LINK RELATIVES		
	GASOLINE	KEROSINE	LIGHT DIESEL FUEL
1947/1946 a/	1.357	1.255	1.313
1948/1947 b/	1.120	1.170	(1.645) c/
1949/1948 d/	1.100	1.170	1.320
1950/1949 e/	1.170	1.080	1.580
1951/1950 f/	1.200	1.030	1.450
1952/1951 g/	1.260	(1.000) c/	1.340
1953/1952 h/	1.110	1.230	(1.120) c/
1954/1953 i/	1.090	1.050	1.440
1955/1954 j/	1.180	1.310	1.310
1956/1955 k/	1.249	(1.075) c/	1.322

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a/ 26/

b/ 27/

c/ Not reported. Estimated on the basis of other data. The yield of light diesel fuel in 1955 has been cited as 4.1 times that of 1950 28/ and 19 times that of 1946. 29/ The context of the source indicating that production was 19 times that of 1946 led to the conclusion that this was a rounded figure presented in an attempt to claim the greatest possible increase in diesel fuel production. Consequently, this figure has been interpreted as 18.5 times 1946 production. The yield of kerosine in 1955 was 3.2 times that of 1946. 30/ This information coupled with the link relatives shown above permitted calculation of the missing link relative for kerosine production in 1952/1951. The link relative for kerosine production in 1956/1955 was estimated as a residual employing the link relatives shown for gasoline, light diesel fuel, and total light products.

d/ 31/

e/ 32/

f/ 33/

g/ 34/

h/ 35/

i/ 36/

j/ 37/

k/ 38/ also 39/ for light diesel fuel.

From the above data the following equations were derived (G = Gasoline, K = Kerosine, and D = Light Diesel Fuel):

$$G_{1946} + K_{1946} + D_{1946} = 7.6$$
(million tons in 1946)

$$1.96\,(G_{1946}) + 1.86\,(K_{1946}) + 4.51^{a/}\,(D_{1946}) = 15.8$$
(million tons in 1950)

$$4.22\,(G_{1946}) + 3.23\,(K_{1946}) + 18.5\,(D_{1946}) = 35.9$$
(million tons in 1955)

Solution of these equations indicates that in 1946, 1950, and 1955 the yields of these products were as follows (in million tons):

	1946	1950	1955
Gasoline	4.26	8.4	18.0
Kerosine	2.87	5.3	9.3
Light Diesel Fuel	0.47	2.1	8.6
TOTAL	7.60	15.8	35.9

The estimated output of 1.6 million tons of heavy diesel fuel in 1955 was based on consumption data.

b. Lubricants

The yield of lubricants has been reported as equal to about 4 percent of the crude oil charge in 1955. 40/ Based on the estimated crude oil charge of 68.4 million tons in 1955, the yield of lubricants is estimated to have been 2.7 million tons.

Allowing 8 percent of the crude oil charge for refinery gas and loss, the total output of nongas products in 1955 was estimated at 62.9 million tons. Summation of the above estimates of distillate fuels and lubricants permitted calculation of the output of "residual and other products" as a remainder.

---

a/ Coefficient was derived from unrounded data. Also agrees with the Soviet statement that production of light diesel fuel in 1955 was 4.1 times that of 1950, see Footnote C, Page 168.

The methodology described above by which estimates of petroleum product output in 1955 were derived is illustrative of the methods employed in developing series of estimates of the output of the various products during the years 1946-1956.

4. Output of Petroleum Products, 1958

a. Light Products

Starting with the crude oil charge of 104 million tons in 1958 and allowing 8 percent for refinery and loss indicated a total yield of 95.7 million tons of nongas products. Of this amount, approximately 56.2 million tons are estimated to have been light products. This estimate, equal to about 54 percent of the crude oil charge, was based on the fact that the yield of light products in 1956 was 5.22 times that of 1946 and in 1957 was 6.03 times that of 1946. 41/ These data, related to the estimated output of 8.4 million tons of light products in 1946 and to the estimated crude oil charges of 80.7 million tons in 1956 and 93 million tons in 1957, indicated that the yield of light products was equal to about 54 percent in both years. On this basis it appeared reasonable to estimate that the output of light products was equal to about 54 percent of the crude oil charge in 1958.

b. Diesel Fuel

Total diesel fuel production in 1958 is estimated to have been 24.7 million tons. This estimate was based on the fact that diesel fuel consumption in railroad locomotives in 1958 was 1.2 million tons 42/ or 4.6 percent of total consumption of diesel fuel during the year. 43/ These data would imply a total consumption of 26 million tons of diesel fuel in 1958. This estimate was adjusted downward to the lowest possible consumption compatible with the possible rounding of the data cited, i.e. 1.15 million tons consumed by the railroads + 4.649 percent = 24.7 million tons total consumption. This adjustment was believed necessary for the following reasons: Refining output of light diesel fuel in 1958, prior to September, represented 37 percent of the total yield of light products.44/ If this relationship prevailed throughout the year and total production of diesel fuel were 26 million tons, about 21 million tons of light diesel fuel and 5 million tons of heavy diesel fuel would have been produced. Such a yield of light diesel fuel would have been compatible with previous performance, but 5 million tons of heavy diesel fuel appears excessive in the light of previous output patterns, the known technology of the industry, and the fact that until the beginning of the Seven Year Plan emphasis was placed on maximizing the percentage yield of light, rather than heavy diesel fuel. This fact, coupled with frequent complaints concerning the continued short supply of diesel fuel in the USSR indicate holding the estimate of total diesel fuel production at the minimum compatible with available data.

The respective shares of total diesel fuel production represented by light and heavy diesel fuels were assumed to be the same in 1958 as those estimated for 1956--86 percent light and 14 percent heavy. Thus it was estimated that about 21.2 million tons of light diesel fuel and 3.5 million tons of heavy diesel fuel were produced in 1958. The estimate of diesel fuel production in 1956 was based on a 32.2 percent increase in the output of light diesel fuel above the production of such fuel in 1955 45/ and on an assumed 18 percent increase in heavy diesel fuel production to keep pace with the 18 percent increase in the crude oil charge that occurred in 1956. 46/ Thus it is estimated that in 1956 about 11.4 million tons of light and 1.9 million tons of heavy diesel fuel were produced.

With an estimate of 56.2 million tons of light products and 3.5 million tons of heavy diesel fuel, total production of the principal distillate fuels in 1958 must have been 59.7 million tons.

c. Lubricants

Production of lubricants in 1956 was about 25 percent more than in 1955 47/ and the same rate of growth has been assumed for 1957. This led to an estimated production in 1957 of 4.2 million tons of lubricants which is equal to about 4.5 percent of the estimated crude oil charge for that year. On the basis of additions to capacity in 1957-58, and shifts in the product mix, lubricant production is estimated to have represented a slightly smaller percentage of the crude oil charge in 1958 than it did in 1957. Lubricant production in 1958 is estimated to have been 4.6 million tons which is equal to 4.4 percent of the crude oil charge.

d. Residuals

Subtracting the sum of the estimates of production of lubricants and principal distillate fuels from the estimated total output of nongas products resulted in an estimate of 31.4 million tons for the category "residual and other products."

After deducting 21.2 million tons of light diesel fuel from the estimated 56.2 million tons of light products, 35 million tons remained to be divided between gasoline and kerosine. Kerosine production was estimated as follows: In 1956, gasoline production was 24.9 percent greater and light diesel fuel was 32.2 percent greater than similar production in 1955. 48/ These data indicated that 22.5 million tons of gasoline and 11.4 million tons of light diesel fuel were produced in 1956. The production of light products in 1956 was 20.8 percent more than in 1955. 49/ This implies production of 43.9 million tons of light products. Subtracting from this figure the estimated production of gasoline and light diesel fuel (33.9 million tons) leaves 10 million tons of kerosine produced in 1956. Kerosine production increased by 4.7 million tons between 1950 and 1956. During the same period the crude oil charge to refineries increased by 44.4 million tons. Thus each increase of 1 million tons in crude oil charge was accompanied, on the average, by an increase of about 106,000 tons in the production of kerosine. (as a result of relatively greater production of kerosine in earlier years the average increase in production of kerosine accompanying each million tons increase in crude oil charge was about 117,000 tons for the period 1946-1956.) The crude oil charge is estimated to have increased by 12.3 million tons in 1957 and by 11 million tons in 1958. Assuming an increase in kerosine production of 106,000 tons per million tons of increase in the crude oil charge indicates production of 11.3 million tons of kerosine in 1957 and 12.5 million tons in 1958. This left 22.5 million tons as the estimate of gasoline production in 1958.

5. Output of Petroleum Products, 1965

The derivation of the output of various products believed to be planned for 1965 is described above as the methodology used in estimating the possible crude oil charge capacity of Soviet refineries in 1965.

6. Output of Petroleum Products, 1959, 1960

The output of petroleum products in 1959 and 1960 was estimated by interpolation between the percentages of crude oil charge represented by the various products in 1958 and the corresponding percentages estimated for 1965. Except for the category "residual and other products", which was derived as a remainder, heavy diesel fuel is the only product for which an increasing share of the crude oil charge is indicated. The production of heavy diesel fuel, which in 1958 was equal to 3.4 percent of the crude oil charge, is to be equal to 5.2 percent of the crude oil charge in 1965. This would require an increase of 6.2 percent per year in the share of crude oil charge represented by production of heavy diesel fuel. The shares of the crude oil charge represented by other products were estimated as decreasing at the following average annual rates:

	ANNUAL DECREASE (PERCENT)
Gasoline	3.80
Kerosine	0.98
Light Diesel Fuel	4.40
Lubricant Base Oils	2.40

7. Estimated Consumption of Petroleum Products in 1965

During the period 1955-60 each 1 percent increase (on the base 1955 = 100) in industrial production was accompanied by an increase of about 1.02 million tons in total consumption of crude oil. If it is assumed that this relationship will continue through 1965, and that industrial production will grow at an average annual rate of about 8.7 percent, total Soviet consumption of crude oil in 1965 would be about 200 million tons. Allowing about 4 million tons for loss, storage, and direct use of natural crude oil (about 1.5 percent of the estimated production of 265 million tons), 196 million tons out of the 200 million would be charged to refineries. This amount would yield about 16 million tons of refinery gas and loss and 180 million tons of nongas products. That this figure is in the right general order of magnitude is indicated by a Soviet economist who wrote in 1959 that petroleum product demand in 1972/75 is to be 3.98 times the petroleum product consumption in 1958 and 1.91 times the demand in 1965. 50/ The consumption of petroleum products in 1958 has been estimated at 89.9 million tons. (Application of the percentage increases contained in the Soviet article would indicate that petroleum product consumption will be 187 million tons in 1965 and 358 million tons in 1972/75.) The unofficial nature of the 1959 article, and the fact that it contained data concerning consumption of individual products in 1965 that would necessitate more rapid growth in their consumption than has occurred in the years 1958-60, led to preference for the rounded estimate of 180 million tons of petroleum products, with an estimated margin of error of about plus or minus 5 percent.

SECTION 11

TRANSPORTATION OF PETROLEUM

A. Railroads

Railroads not only have been the backbone of the transportation system of the USSR, but also have provided the major means of transport of petroleum. In 1958, for example, the railroads accounted for 81.2 percent of the ton-kilometers reported in freight transport and for 62.7 percent of petroleum traffic. Recently, Soviet plans for a spectacular increase in the petroleum pipeline system have been given wide publicity. Although successful implementation of this construction program will significantly increase the role of pipeline transport in the movement of petroleum freight, railroads will continue to account for the largest share--more than 46 percent in 1965--of petroleum traffic in the USSR.

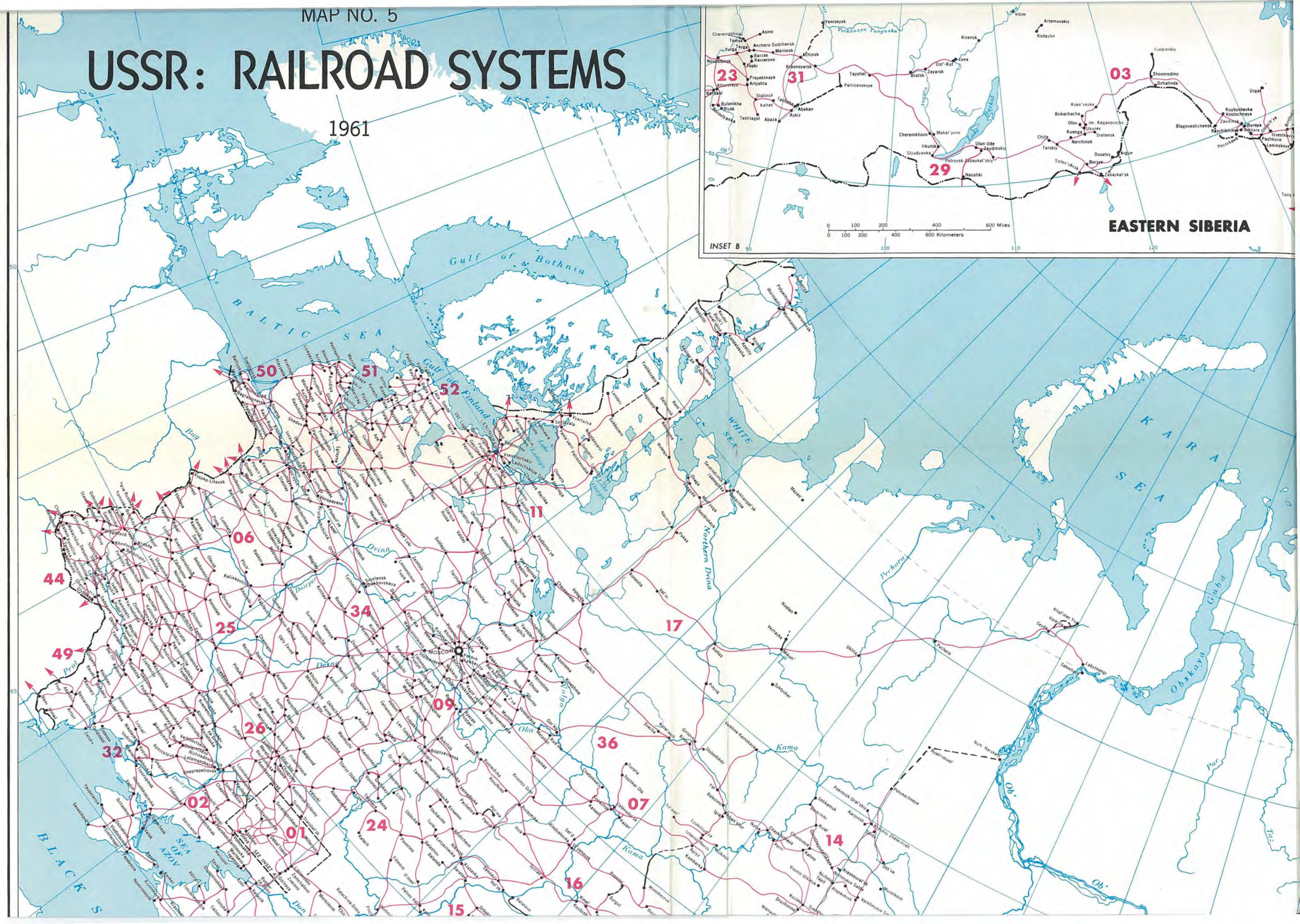
Map No. 5, "USSR: Railroad Systems, 1961" has been made available by the Association of American Railroads from Railroads of the USSR, the report on the visit of the U.S. Railroad Exchange Delegation to the Soviet Union. 1/ This map locates those railroad systems in existence in the Soviet Union in 1961. All Soviet refinery installations are linked by rail with current crude oil producing areas, although some of the potentially important future crude producing areas are not served by the present network.

Total and petroleum rail freight traffic for selected years 1945-60, together with announced plans for 1965, is shown in Table 3-46. It can be seen that in 1965 a substantially higher volume of petroleum freight traffic is planned than is currently carried, reflecting the plans for rapid growth in crude production. Petroleum freight is to increase from 154 billion ton-kilometers in 1958 to 251 billion ton-kilometers in 1965, according to the original Seven Year Plan. Current Soviet plans for expansion of rail petroleum traffic by 1965 exceed the original goal by about 8 percent and now reach to 270 billion ton-kilometers. This revised goal represents a 75 percent increase compared with 1958. Furthermore, the percentage of total railroad freight which is devoted to petroleum is continually growing and is to increase from about 10 percent in 1955 to 14 to 15 percent in 1965.

USSR RAILROAD SYSTEMS
KEY TO MAP NO. 5

NUMBER*	NAME	TRANSLITERATED RUSSIAN NAME
01	Donets	Donetskaya
02	Stalin	Stalinskaya
03	Transbaykal	Zabykal'skaya
04	Transcaucasus	Zakavkazskaya
06	Belorussian	Belorusskaya
07	Kazan	Kazanskaya
09	Moscow	Moskovskaya
11	October	Oktyabr'skaya
12	Omsk	Omskaya
13	South Ural	Yuzhno-Ural'skaya
14	Sverdlovsk	Sverdlovskaya
15	Volga	Privolzhskaya
16	Kuybyshev	Kuybyshevskaya
17	Northern	Severnaya
18	North Caucasus	Severo-Kavkazskaya
20	Ashkhabad	Ashkhabadskaya
23	Tomsk	Tomskaya
24	Southeastern	Yugo-Vostochnaya
25	Southwestern	Yugo-Zapadnaya
26	Southern	Yuzhnaya
27	Far-Eastern	Dal'ne-Vostochnaya
29	East Siberian	Vostochno-Sibirskaya
31	Krasnoyarsk	Krasnoyarskaya
32	Odessa	Odesskaya
34	Kalinin	Kalininskaya
36	Gor'kiy	Gor'kovskaya
39	Tashkent	Tashkentskaya
40	Kazakh	Kazakhskaya
44	L'vov	L'vovskaya
49	Moldavian	Moldavskaya
50	Lithuanian	Litovskaya
51	Latvian	Latviyskaya
52	Estonian	Estonskaya
56	Azerbaydzhan	Azerbaydzhanskaya
57	South Sakhalin	Yuzhno-Sakhalinskaya

* The system numbers follow the listing in TARIFNOYE RUKOVODSTVO, N. 4 (Tariff Handbook) Transzheldorizdat, Moscow, 1958.



MAP NO. 5
USSR: RAILROAD SYSTEMS
1961
EASTERN SIBERIA
INSET B
0 100 200 400 600 Miles
0 100 200 400 600 Kilometers
Gulf of Bothnia
BALTIC SEA
Gulf of Finland
WHITE SEA
KARA SEA
BLACK SEA
SEA OF AZOV
Obskaya Guba
Northern Dvina
Pechora
Kama
Oka
Volga
Dnieper
Desna
Dvina
Don
Prut
Bug
Ob'
Pur
Lake Baykal
Angara
Lena
Verkhnaya Tunguska
MOSCOW
LENINGRAD
Krasnoyarsk
Irkutsk
Ulan Ude
Chita
Tayshet
Novosibirsk
Vorkuta
Labytnangi
Salekhard
Kotlas
Kirov
Perm
Sverdlovsk
Smolensk
Kazan'
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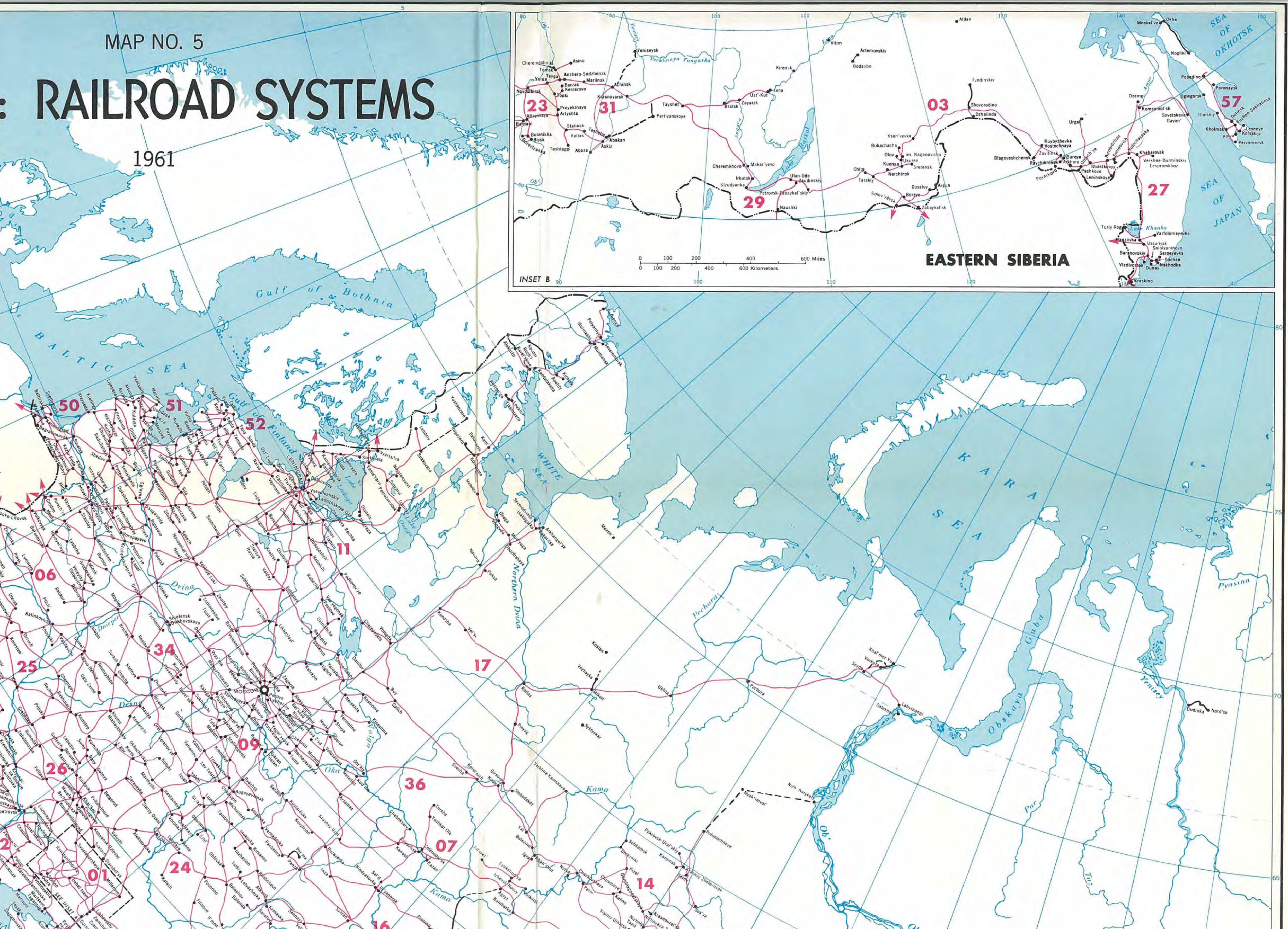
MAP NO. 5
: RAILROAD SYSTEMS
1961
EASTERN SIBERIA
INSET B
SEA OF OKHOTSK
SEA OF JAPAN
0 100 200 400 600 Miles
0 100 200 400 600 Kilometers
Gulf of Bothnia
BALTIC SEA
Gulf of Finland
WHITE SEA
KARA SEA
Northern Dvina
Pechora
Obskaya Guba
Yenisey
Pyasina
Kama
Oka
Dnieper
Dvina
MOSCOW
LENINGRAD
Arkhangel'sk
Vorkuta
Salekhard
Labytnangi
Dudinka
Noril'sk
Khabarovsk
Vladivostok
Irkutsk
Ulan-Ude
Chita
Krasnoyarsk
Tayshet
Bratsk
Novosibirsk
Tomsk
Lake Baykal
Lake Khanka
SEE INSET A
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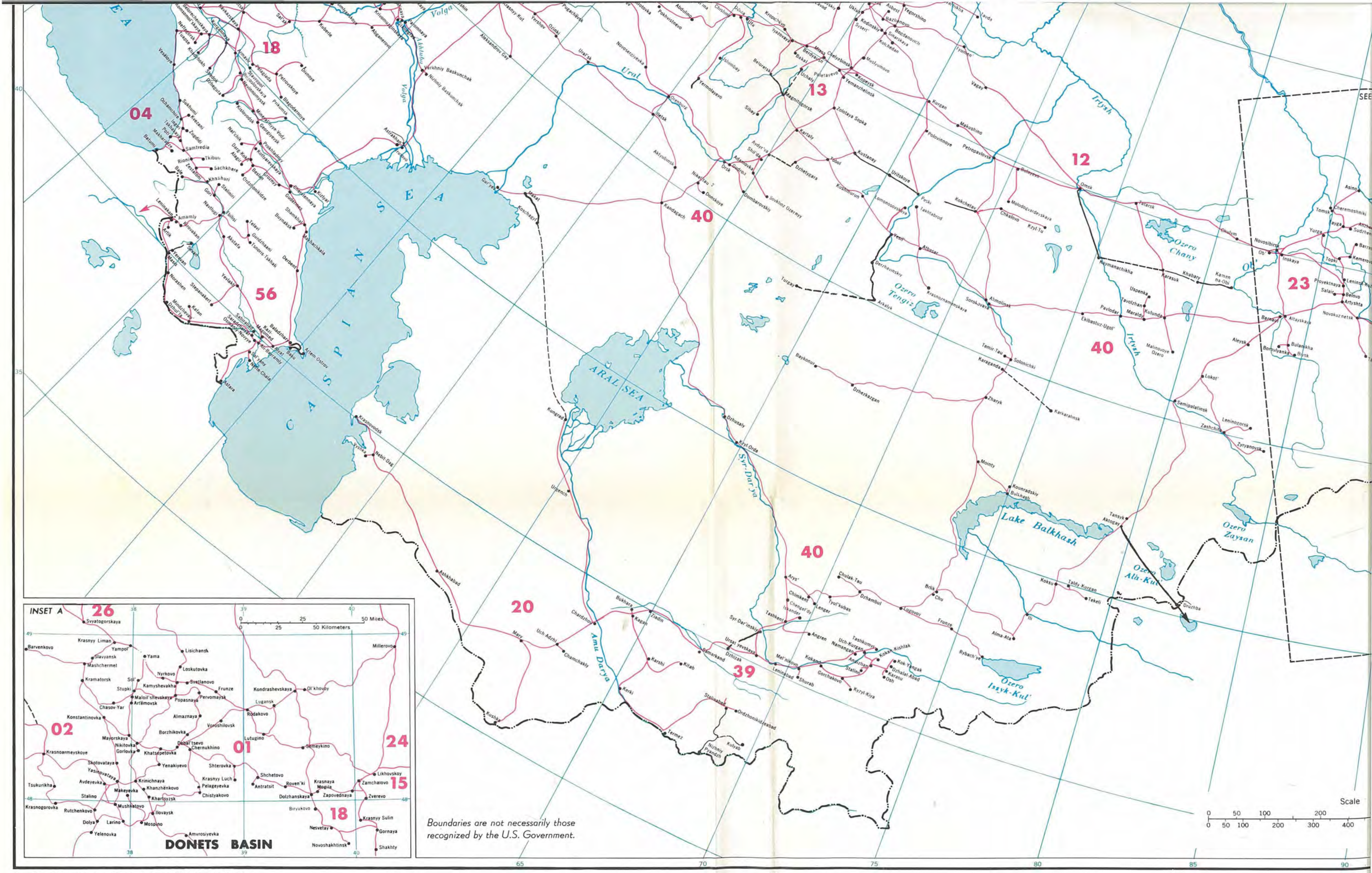

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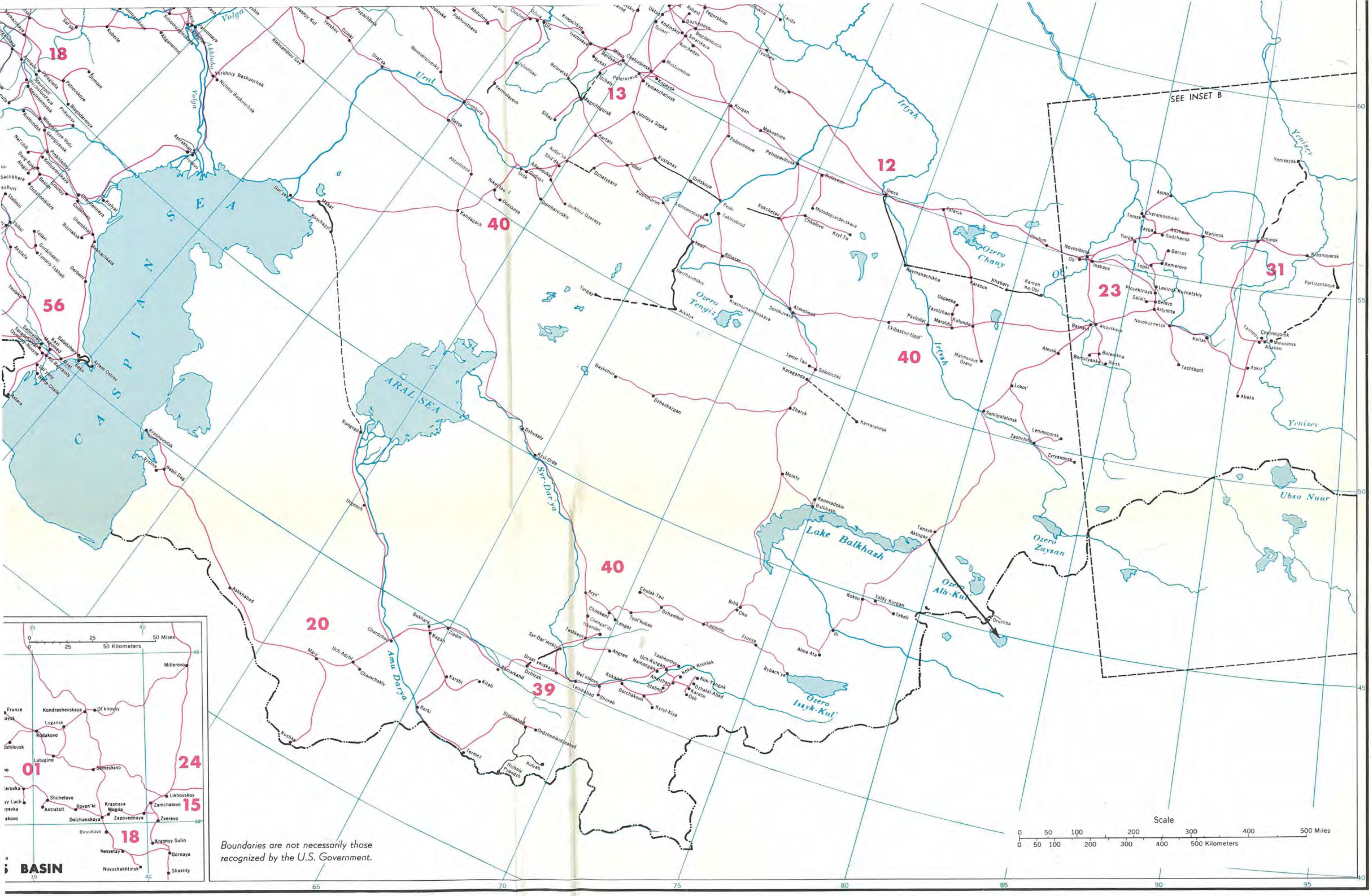


CASPIAN SEA
ARAL SEA
Lake Balkhash
Ozero Issyk-Kul'
Ozero Chany
Ozero Tengiz
Ozero Zaysan
Ozero Ala-Kul'
Ubsa Nuur
Volga
Ural
Irtysh
Ob'
Yenisey
Syr-Dar'ya
Amu Darya
SEE INSET B
Scale
0 50 100 200 300 400 500 Miles
0 50 100 200 300 400 500 Kilometers
18
13
12
40
56
23
31
20
39
01
24
15
Astrakhan'
Gur'yev
Orenburg
Magnitogorsk
Kurgan
Omsk
Novosibirsk
Tomsk
Kemerovo
Krasnoyarsk
Barnaul
Semipalatinsk
Karaganda
Tselinograd
Kustanay
Petropavlovsk
Pavlodar
Krasnovodsk
Nebit-Dag
Ashkhabad
Mary
Chardzhou
Bukhara
Samarkand
Tashkent
Chimkent
Dzhambul
Frunze
Alma-Ata
Kzyl-Orda
Dzhusaly
Kungrad
Urgench
Termez
Kushka
Kerki
Karshi
Stalinabad
Leninabad
Andizhan
Namangan
Osh
Druzhba
Baykonur
Dzhezkazgan
Kounradskiy
Mointy
Tashtagol
Abaza
Minusinsk
Achinsk
Mariinsk
Biysk
Aleysk
Rubtsovsk
Zyryanovsk
Taldy Kurgan
Tekeli
Boundaries are not necessarily those recognized by the U.S. Government.
BASIN
Millerovo
Kondrashevskaya
Lugansk
Rodakovo
Lutugino
Semeykino
Shchetovo
Antratsit
Roven'ki
Krasnaya Mogila
Dolzhanskaya
Zapovednaya
Zamchalovo
Likhovskoy
Zverevo
Krasnyy Sulin
Gornaya
Shakhty
Novoshakhtinsk
Nesvetay
25 50 Miles
25 50 Kilometers

Railroads

TABLE 3-46

TRANSPORT OF PETROLEUM BY RAIL IN THE USSR COMPARED TO TOTAL RAIL TRAFFIC SELECTED YEARS 1945-65

	BILLION METRIC TON-KILOMETERS		
	TOTAL RAIL FREIGHT	PETROLEUM FREIGHT	PETROLEUM FREIGHT AS PERCENT OF TOTAL RAIL FREIGHT
1945 a/	314.0	23.8	7.6
1950 b/	602.3	52.0	8.6
1955 c/	970.9	101.6	10.5
1958 c/	1,302.0	154.0	11.8
1960 c/	1,504.3	205.4	13.7
1965 Plan	1,800.0 d/	251.0 e/	13.9
1965 Revised	1,800.0 f/	270.0 e/	15.0 f/

a/ 2/
b/ 3/
c/ 4/
d/ 5/
e/ 6/
f/ Assuming no change in total rail freight.

To supply the growing demand for rail transportation, the Seven Year Plan provides for substantial increases in railroad facilities. The Plan visualizes a total expenditure of 11-11.5 billion rubles on reconstruction of the railroad system, which is 83 percent greater than expenditures during the previous seven years. 7/ In an analysis of Soviet transportation plans made in 1959 by a recognized expert in the field, it was concluded that the program for the expansion of the railroads was feasible. 8/

Tank car inventory is to increase by 87 percent during 1959-65 (compared with 75 percent increase in petroleum traffic). 9/ In addition, capacity per tank car is expected to increase by an unspecified amount. At present 80 to 85 percent of Soviet tank cars are 4-axle, 50 cubic-meter cars. The remainder are 2-axle, 20-25 cubic-meter cars. Four-axle, 60-cubic-meters and 6-axle, 90-cubic-meter cars are being introduced slowly. The total number of tank cars in the USSR in 1958 has been estimated at about 98,100, 9/ thus bringing the 1965 planned number to 183,400. Tank car inventory in 1960 was estimated at 114,000. 9/

In 1959, tank cars comprised 12 percent of the total freight rolling stock of the Soviet railroad system, as shown in the following table.

TABLE 3-47

DISTRIBUTION OF FREIGHT ROLLING STOCK IN THE USSR - 1959 a/

TYPE OF ROLLING STOCK	PERCENT OF TOTAL
Box Cars	34.6
Semi-Box or Open-Top Cars	32.6
Flat Cars	17.3
Tank Cars	12.0
Refrigerator Cars	3.5
TOTAL	100.0

a/ 10/

The changing pattern of oil transportation in the USSR is illustrated by Table 3-48. In these statistics, transport of petroleum by truck is negligible. In 1958, 63 percent of all petroleum freight load in the USSR was absorbed by the railroads, and a modest 14 percent of the load was carried by pipelines. The effect of the intensive pipeline construction program during the Seven Year Plan is to increase the oil pipeline traffic from 14 percent of total oil traffic in 1958 to 34 percent of total oil traffic in 1965. Even in 1965, however, 46 percent of petroleum traffic will be by rail.

It is significant to compare the 1965 Plan for petroleum freight with total railroad freight expectations. Table 3-49 shows that petroleum freight will represent 14 percent of total freight traffic (disregarding recent estimates of an even higher possible rail traffic in petroleum). Oil carried by all other means will be the equivalent of only 16 percent of total railroad

TABLE 3-48

TRANSPORT OF PETROLEUM FREIGHT IN THE USSR BY TYPE OF CARRIER a/ 1958 AND 1965 PLAN

TYPE OF CARRIER	1958 BILLION METRIC TON-KILOMETERS	1958 PERCENT OF TOTAL	1965 PLAN BILLION METRIC TON-KILOMETERS	1965 PLAN PERCENT OF TOTAL
Rail	154.0	62.7	251 b/	46.1
Maritime	42.0	17.1	85	15.6
Inland Waterway	15.8	6.4	24	4.4
Pipeline	33.8	13.8	185	33.9
TOTAL	245.6	100.0	545	100.0

a/ 11/
b/ Soviet estimates of transport of petroleum by rail in 1965 have been recently revised to 270 billion ton-kilometers.

TABLE 3-49

COMPARISON OF USSR PETROLEUM TRANSPORTATION REQUIREMENTS WITH PLANNED TOTAL RAILROAD FREIGHT IN 1965

TYPE OF CARRIER	PETROLEUM FREIGHT (BILLION METRIC TON-KILOMETERS)	PETROLEUM FREIGHT AS A PERCENT OF TOTAL RAIL FREIGHT
Rail	251	14
Maritime	85	5
Inland Waterway	24	1
Pipeline	185	10

freight. Thus, an appreciable shortage in meeting maritime, inland waterway and pipeline expectations would still not represent a large incremental load on the total rail freight carried. Such a deficiency could, however, be serious in terms of available petroleum carrying equipment, for example, tank cars required depend to some extent on turnaround time. There has been severe criticism in the Soviet press of long delays of tank cars at unloading points. Additional capacity may, therefore, be gained by future improvements in utilization.

Costs of rail transport have been gradually declining as utilization improves and automation increases. This decline is illustrated in the following tabulation. 12/

AVERAGE COST OF ALL RAIL FREIGHT MOVEMENT IN THE USSR

	KOPECKS/TON-KILOMETER
1950	0.5252
1955	0.3932
1958	0.3349
1959	0.3155
1960	0.3064

Complete information on the cost of petroleum freight movements specifically is not available. However, the 1958 cost has been given as 0.326 kopecks per ton-kilometer, 13/ which is comparable to the average cost of all rail freight movement.

Prior to the emergence of the USSR as a major exporter of petroleum, the average length of haul of petroleum by rail in the USSR exceeded that of any other carrier. In 1955 the average length of haul of petroleum by rail was more than 4.5 times that by pipeline, as shown in Table 3-50. Following the increase in exports of petroleum and the concomitant growth in tanker movements, the average length of haul of petroleum by Soviet-owned ocean-going vessels reached 1,534 kilometers in 1958, displacing rail in terms of longest average hauls. Estimates for 1965 indicate that ocean-going vessels will continue to carry petroleum over the longest average distances, but also that the length of haul by pipeline will more than double during the Seven Year Plan as the result of completion of lengthy pipeline systems leading eastward and westward from the producing centers.

TABLE 3-50

AVERAGE LENGTHS OF HAUL OF PETROLEUM
IN THE USSR, BY CARRIER
1950, 1955, 1958, 1960 AND 1965 ESTIMATE
(Kilometers)

CARRIER	1950 a/	1955 a/	1958	1960	ESTIMATE 1965
Rail	1,205	1,309	1,369 b/	1,360 b/	1,300
Ocean*	700	1,307	1,534 a/	NA	1,700
River	1,018	1,000	1,006 a/	1,000 (Estimate)	1,000
Pipeline	309	284	355 a/	394 c/	777 d/

* Soviet-owned vessels only.
a/ 14/
b/ 15/
c/ 16/
d/ 17/

B. Inland Waterways

Inland Waterways play only a minor and decreasing role in the movement of petroleum freight within the USSR. As shown in Table 3-51, although the amount of petroleum freight to be moved by inland waterway is to increase by 50 percent during the Seven Year Plan, 18/ less significance will be attached to this means of transport, as its share in the total movement of petroleum freight is to decline from 6.4 percent in 1958 to 4.4 percent in 1965, largely as a result of the increasing role to be played by pipelines.

The bulk of the petroleum freight handled by inland waterway moves along the Volga, Kama and Belaya rivers. These rivers connect the crude oil producing and refining centers in the Urals-Volga region with the Caspian Sea, the Black Sea by means of the Volga-Don Canal and allow the transport of lesser quantities of petroleum products westward to the heavy consuming centers of the European USSR. Prior to the beginning of the Seven Year Plan, almost 80 percent of the petroleum freight hauled by river tanker and barge moved along the Volga and Kama rivers. 19/ This share is to be essentially preserved during

1959-65, although somewhat higher rates of growth will be obtained by petroleum shipments on the Amur, Lena, Yenesey, Ob' and Irtysh. The inland waterway system of the USSR is illustrated on Map No. 6.

Within the past several years, the character of movement of petroleum freight along the Volga River has been changed drastically. At one time, when Baku was the crude oil producing and refining center, petroleum products would move up the Volga. Following the emergence of the Urals-Volga as a center of production and refining, crude oil and sulphurous mazut move down the Volga. The mazut is used as a fuel in electric power plant boilers. The crude is charged to refineries located in the Caucasus, the quantities making up for the difference between local crude oil production and the available charge capacity. Low sulphur mazut, high octane gasolines and quality lubricants from the Baku, Krasnovodsk and Groznyy refineries are shipped by sea-going tanker on the Caspian to the trans-shipping facilities at Astrakhan where the products are loaded onto river vessels. From Astrakhan the cargoes move up the Volga and Kama rivers to the industrial regions along the Volga, Moscow, Leningrad and in some cases, ultimately to the Urals, Siberia and the Far East.

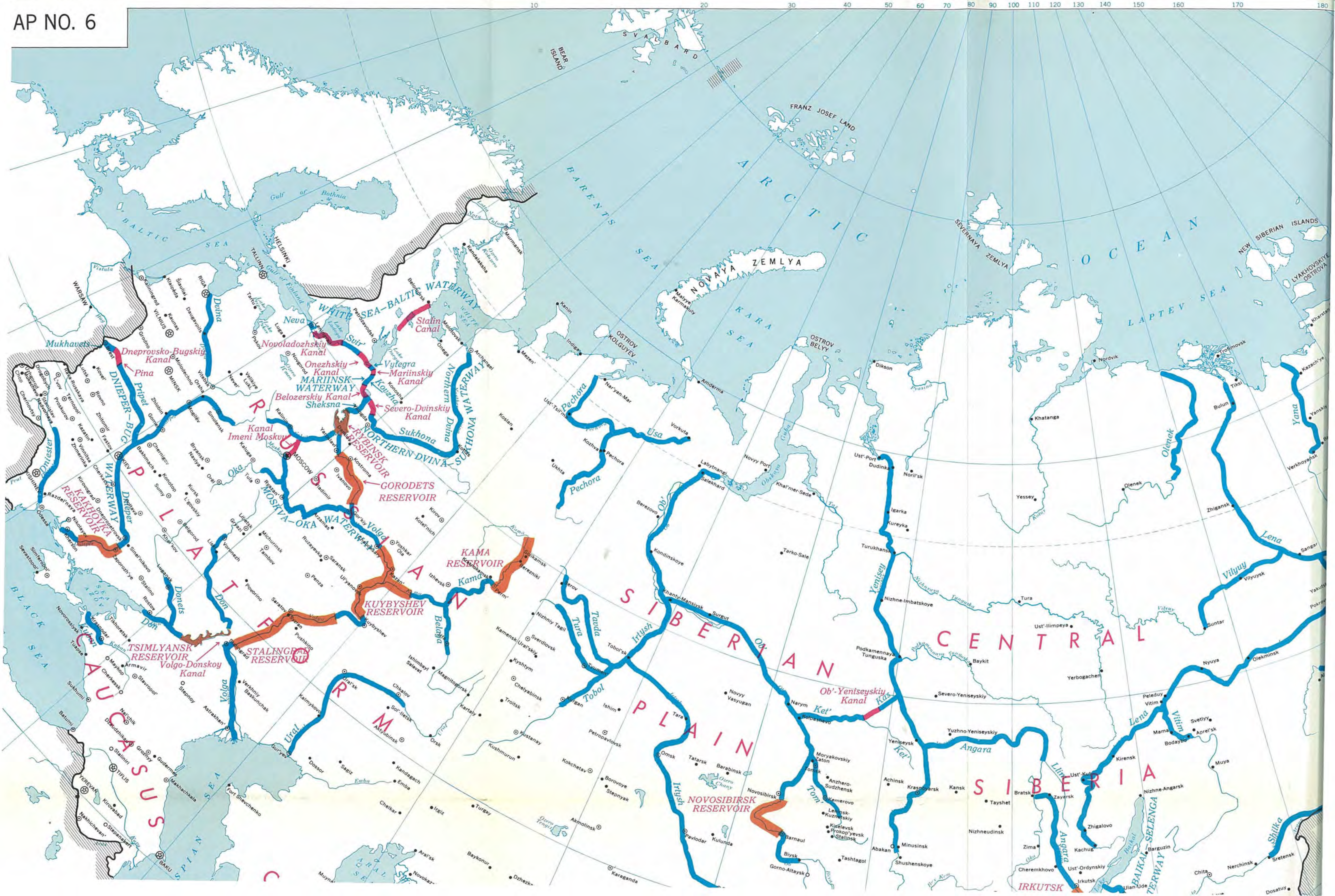
TABLE 3-51

MOVEMENT OF PETROLEUM FREIGHT
BY INLAND WATERWAYS OF THE USSR
1955-60 AND 1965 PLAN

YEAR	MILLION METRIC TONS-ORIGINATED	PERCENT OF NATIONAL TOTAL
1955	14.4	8.6
1956	15.0	NA
1957	16.1	NA
1958	16.2	6.4
1959	17.7	NA
1960	18.5	NA
1965 Plan	24.0	4.4

The largest river tanker operating on the Volga, Kama and Don has a 5,000 ton rating. [20] Use of this larger vessel (prior to its introduction, 3,300 ton ratings were the largest) should assist in reducing the cost of petroleum movement by the river fleet.

AP NO. 6



SVALBARD
BEAR ISLAND
FRANZ JOSEF LAND
BARENTS SEA
ARCTIC OCEAN
NOVAYA ZEMLYA
KARA SEA
SEVERNAYA ZEMLYA
LAPTEV SEA
NEW SIBERIAN ISLANDS
LYAKHOVSKIYE OSTROVA
OSTROV KOLGUYEV
OSTROV BELYY
Gulf of Bothnia
BALTIC SEA
Gulf of Finland
WHITE SEA
HELSINKI
TALLINN
RIGA
VILNIUS
MINSK
WARSAW
KIEV
MOSCOW
Murmansk
Kandalaksha
Belomorsk
Petrozavodsk
Arkhangel'sk
Mezen'
Kotlas
Vologda
Kostroma
Ivanovo
Vladimir
Gor'kiy
Kazan'
Kirov
Kotel'nich
Izhevsk
Perm'
Solikamsk
Berezniki
Ufa
Kuybyshev
Saratov
Penza
Saransk
Ul'yanovsk
Stalingrad
Astrakhan'
Rostov
Voronezh
Tambov
Michurinsk
Khar'kov
Kursk
Orel
Bryansk
Smolensk
Kaluga
Tula
Ryazan'
Kalinin
Novgorod
Pskov
Luga
Chernigov
Odessa
Kherson
Nikolayev
Zaporozh'ye
Dnepropetrovsk
Kirovograd
Poltava
Sevastopol'
Simferopol'
Novorossiysk
Tuapse
Sukhumi
Batumi
Krasnodar
Stavropol'
Armavir
Grozny
Makhachkala
Nal'chik
TIFLIS
YEREVAN
BAKU
Kirovabad
Nakhichevan'
Stepanakert
Guryev
Ural'sk
Chkalov
Orsk
Aktyubinsk
Magnitogorsk
Chelyabinsk
Sverdlovsk
Nizhniy Tagil
Kamensk-Ural'skiy
Kyshtym
Troitsk
Kustanay
Kurgan
Tobol'sk
Tyumen'
Ishim
Petropavlovsk
Kokchetav
Akmolinsk
Karaganda
Omsk
Tara
Tatarsk
Barabinsk
Pavlodar
Kulunda
Novosibirsk
Barnaul
Biysk
Gorno-Altaysk
Tomsk
Kemerovo
Anzhero-Sudzhensk
Leninsk-Kuznetskiy
Kiselevsk
Prokop'yevsk
Stalinsk
Tashtagol
Abakan
Minusinsk
Shushenskoye
Achinsk
Krasnoyarsk
Kansk
Tayshet
Nizhneudinsk
Zima
Cheremkhovo
IRKUTSK
Ulan-Ude
Bratsk
Zayarsk
Ust'-Kut
Kirensk
Zhigalovo
Kachug
Ust'-Ordynskiy
Barguzin
Nizhne-Angarsk
Chita
Nerchinsk
Sretensk
Bodaybo
Mama
Svetlyy
Aprel'sk
Muya
Vitim
Peleduy
Olekminsk
Nyuya
Suntar
Vilyuysk
Yakutsk
Sangar
Zhigansk
Verkhoyansk
Bulun
Tiksi
Kazach'ye
Khatanga
Nordvik
Yessey
Olenek
Dikson
Dudinka
Noril'sk
Igarka
Kureyka
Turukhansk
Nizhne-Imbatskoye
Podkamennaya Tunguska
Baykit
Yerbogachen
Ust'-Ilimpeya
Severo-Yeniseyskiy
Yuzhno-Yeniseyskiy
Yeniseysk
Narym
Kolpashevo
Moryakovskiy Zaton
Novyy Vasyugan
Surgut
Khanty-Mansiysk
Kondinskoye
Berezovo
Salekhard
Labytnangi
Novyy Port
Khal'mer-Sede
Tarko-Sale
Vorkuta
Nar'yan-Mar
Ust'-Tsil'ma
Kozhva
Pechora
Ukhta
Koslan
Amderma
Kanin
Indiga
Serov
Dneprovsko-Bugskiy Kanal
Pina
DNIEPER-BUG WATERWAY
Pripet
Mukhavets
Dniester
Prut
Dnieper
KAKHOVKA RESERVOIR
Dvina
Neva
Svir'
WHITE SEA-BALTIC WATERWAY
Stalin Canal
Novoladozhskiy Kanal
Onezhskiy Kanal
Vytegra
Mariinskiy Kanal
MARIINSK WATERWAY
Kovzha
Belozerskiy Kanal
Sheksna
Severo-Dvinskiy Kanal
Sukhona
NORTHERN DVINA-SUKHONA WATERWAY
Northern Dvina
Kanal Imeni Moskvy
RYBINSK RESERVOIR
GORODETS RESERVOIR
MOSKVA-OKA WATERWAY
Oka
Volga
KAMA RESERVOIR
Kama
KUYBYSHEV RESERVOIR
Belaya
Don
Donets
TSIMLYANSK RESERVOIR
Volgo-Donskoy Kanal
STALINGRAD RESERVOIR
Kuban
Ural
Emba
Pechora
Usa
Ob'
Irtysh
Tobol
Tura
Tavda
Ket'
Ob'-Yeniseyskiy Kanal
Kas
Tom'
NOVOSIBIRSK RESERVOIR
Yenisey
Angara
Ilim
Lena
Vitim
Vilyuy
Olenek
Yana
Shilka
BAIKAL-SELENGA WATERWAY
RUSSIAN PLATFORM
CAUCASUS
URAL
WEST SIBERIAN PLAIN
CENTRAL SIBERIA
BLACK SEA
SEA OF AZOV
CASPIAN SEA
ARAL SEA

ARCTIC OCEAN
BARENTS SEA
KARA SEA
LAPTEV SEA
EAST SIBERIAN SEA
BERING SEA
SEA OF OKHOTSK
SVALBARD
BEAR ISLAND
FRANZ JOSEF LAND
NOVAYA ZEMLYA
SEVERNAYA ZEMLYA
NEW SIBERIAN ISLANDS
LYAKHOVSKIYE OSTROVA
WRANGEL ISLAND
OSTROV KOLGUYEV
OSTROV BELYY
KOMANDORSKIYE OSTROVA
KURIL ISLANDS
ZALIV SHELEKHOVA
WEST SIBERIAN PLAIN
CENTRAL SIBERIA
FAR EAST
NOVOSIBIRSK RESERVOIR
Ob'-Yeniseyskiy Kanal
AMUR-SHILKA WATERWAY
BAIKAL SELENGA WATERWAY
IRKUTSK
Pechora
Usa
Ob'
Irtysh
Tobol
Tura
Tavda
Ket'
Kas
Tom'
Yenisey
Angara
Ilim
Lena
Vilyuy
Vitim
Aldan
Olenek
Yana
Indigirka
Kolyma
Malyy Anyuy
Bol'shoy Anyuy
Anadyr'
Shilka
Zeya
Selemdzha
Amur
Amgun'
Selenga
Baikal
Nizhnyaya Tunguska
Podkamennaya Tunguska
Kanin
Indiga
Malyye Karmakuly
Nar'yan-Mar
Ust'-Tsil'ma
Amderma
Vorkuta
Kozhva
Pechora
Ukhta
Labytnangi
Salekhard
Novyy Port
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Sverdlovsk
Tobol'sk
Tyumen'
Kurgan
Ishim
Petropavlovsk
Kokchetav
Borovoye
Stepnyak
Akmolinsk
Karaganda
Pavlodar
Kulunda
Omsk
Tara
Tatarsk
Barabinsk
Ozero Chany
Ozero Tengiz
Novosibirsk
Barnaul
Biysk
Gorno-Altaysk
Novyy Vasyugan
Narym
Kolpashevo
Moryakovskiy Zaton
Tomsk
Anzhero-Sudzhensk
Kemerovo
Leninsk-Kuznetskiy
Kiselevsk
Prokop'yevsk
Stalinsk
Tashtagol
Dikson
Pyasina
Ust'-Port
Dudinka
Noril'sk
Igarka
Kureyka
Turukhansk
Nizhne-Imbatskoye
Podkamennaya Tunguska
Baykit
Severo-Yeniseyskiy
Yeniseysk
Yuzhno-Yeniseyskiy
Achinsk
Krasnoyarsk
Kansk
Tayshet
Abakan
Minusinsk
Shushenskoye
Nizhneudinsk
Bratsk
Zayarsk
Zima
Cheremkhovo
Ust'-Ordynskiy
Irkutsk
Ulan-Ude
Kachug
Zhigalovo
Ust'-Kut
Kirensk
Nizhne-Angarsk
Barguzin
Chita
Nerchinsk
Sretensk
Khatanga
Nordvik
Yessey
Kotuy
Tura
Ust'-Ilimpeya
Yerbogachen
Olenek
Tiksi
Bulun
Zhigansk
Sangar
Vilyuysk
Suntar
Yakutsk
Pokrovsk
Olekminsk
Nyuya
Peleduy
Vitim
Mama
Bodaybo
Svetlyy
Aprel'sk
Muya
Tofimovsk
Kazach'ye
Yanskiy
Batagay
Verkhoyansk
Kharstan
Allaykha
Druzhina
Ust'-Nera
Oymyakon
Amga
Allakh-Yun'
El'dikan
Tommot
Aldan
Dzhekonda
Nimnyrskiy
Chagda
Nagornyy
Tyndinskiy
Skovorodino
Yasnyy
Svobodnyy
Blagoveshchensk
Bureya
Birobidzhan
Khabarovsk
Bikin
Komsomol'sk
Nikolayevsk
Chumikan
Ayan
Nel'kan
Yur
Okhotsk
Inya
Khanyangda
Tauysk
Magadan
Yagodnyy
Seymchan
Zyryanka
Sredne-Kolymsk
Nizhne-Kolymsk
Ambarchik
Pevek
Ust'-Chaun
Vankarem
Uelen
Provideniya
Markovo
Ugol'nyy
Penzhino
Kamenskoye
Gizhiga
Korf
Il'pyrskiy
Palana
Tigil'
Ust'-Kamchatsk
Kronotski
Mil'kovo
Petropavlovsk
Kirovskiy
Ust'-Bol'sheretsk
Ozernovskiy
Kashiwabara (Severo-Kuril'sk)
Okha
Aleksandrovsk-Sakhalinskiy
Koton (Pobedino)
Shikuka (Poronaysk)
Kushunnai (Il'inskiy)
Maoka (Kholmsk)
Toyohara (Yuzhno-Sakhalinsk)
Otomari (Korsakov)
Naihoro (Gornozavodsk)
Shana (Kuril'sk)
Furukamappu (Yuzhno-Kuril'sk)
Sovetskaya Gavan'
Nel'ma
Sredniy Urgal
Chekunda
Tyrma
Selemdzhinsk
10
20
30
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90
100
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150
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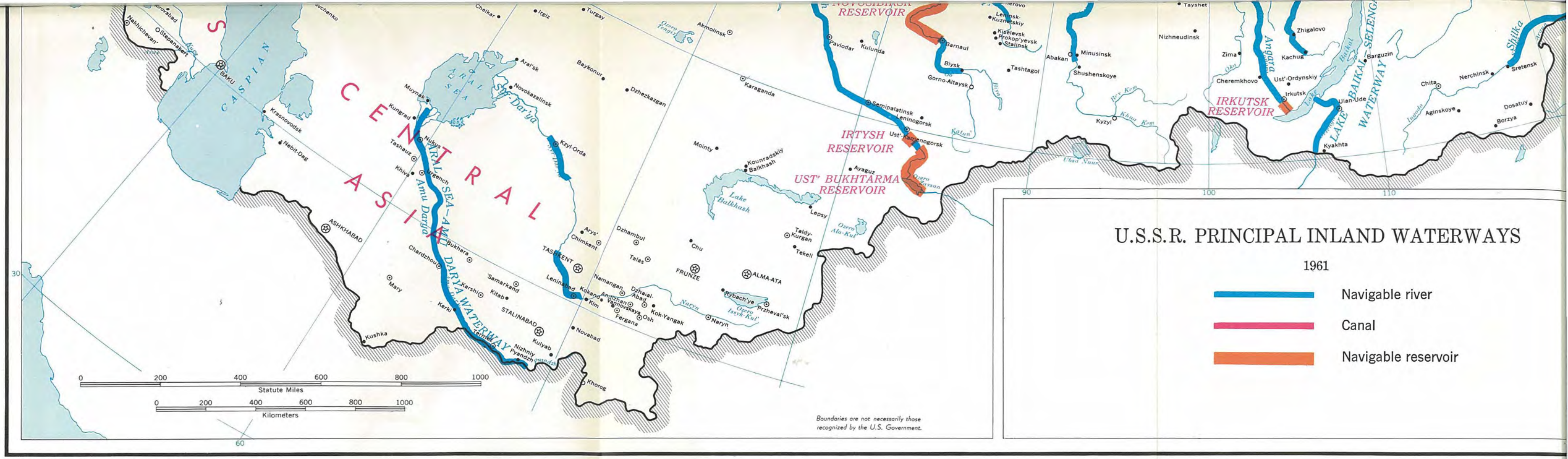
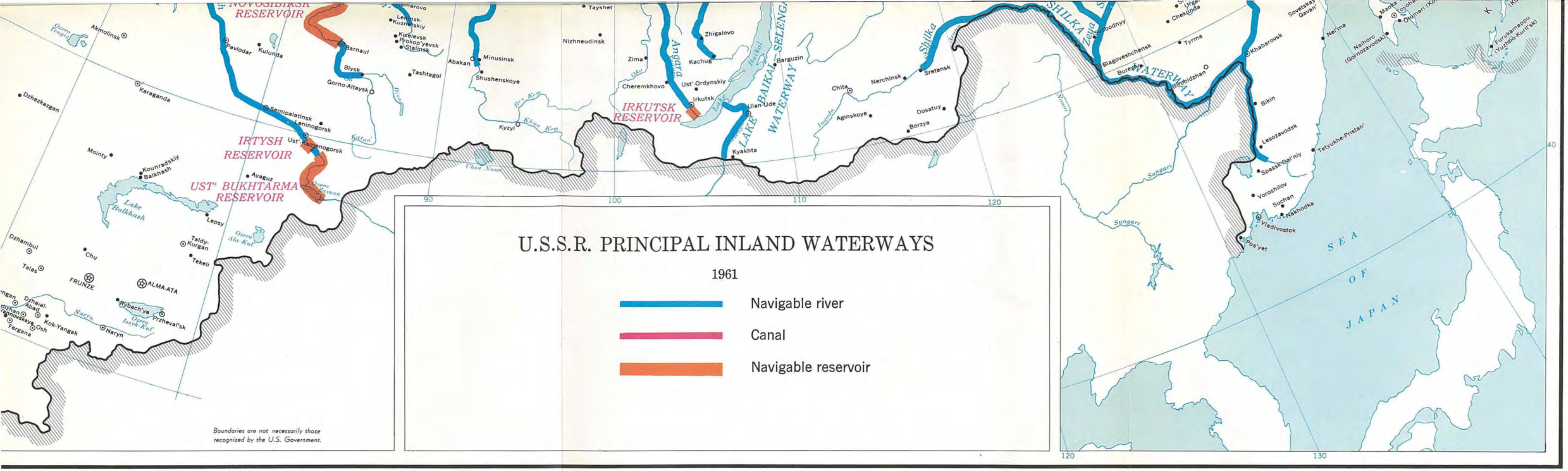
180
170
60
50


U.S.S.R. PRINCIPAL INLAND WATERWAYS
1961
Navigable river
Canal
Navigable reservoir
CENTRAL ASIA
ARAL SEA–AMU DARYA WATERWAY
LAKE BAIKAL–SELENGA WATERWAY
IRTYSH RESERVOIR
UST' BUKHTARMA RESERVOIR
IRKUTSK RESERVOIR
Statute Miles
Kilometers
Boundaries are not necessarily those recognized by the U.S. Government.



U.S.S.R. PRINCIPAL INLAND WATERWAYS
1961
Navigable river
Canal
Navigable reservoir
NOVOSIBIRSK RESERVOIR
IRTYSH RESERVOIR
UST' BUKHTARMA RESERVOIR
IRKUTSK RESERVOIR
LAKE BAIKAL-SELENGA WATERWAY
SHILKA
Angara
SEA OF JAPAN
Boundaries are not necessarily those recognized by the U.S. Government.

Until recently, river transport was the cheapest means of petroleum transport in the USSR. However, the use of large-diameter pipe in the construction of petroleum pipelines has served to lower the cost of transport of oil freight by this means to a level well below that of water transport. According to published Soviet data, in 1958 the transport of petroleum freight by all forms of transport was as follows: 21/

FORM OF TRANSPORT	KOPECKS/TON-KILOMETER
Railroad	0.33
River - Sea	0.16-0.17
Pipeline	0.12

One problem which continually has plagued the expansion of petroleum movement by river is the transport of petroleum freight along rail routes which parallel navigable rivers. Soviet river authorities often have pointed out the inconsistencies in such planning, but to no avail.

C. Pipeline Transportation (Petroleum and Natural Gas)

1. Summary

At the end of 1958 the Soviet Union had in operation only 14,461 kilometers of crude oil and petroleum product pipelines and 13,239 kilometers of gas pipelines. The Seven Year Plan calls for construction of 31,800 kilometers of oil pipelines and 29,500 kilometers of gas pipeline.* Thus in these seven years it is planned to construct more than twice as much trunk line as existed at the beginning of the current Seven Year Plan.

These pipeline systems are designed to accomplish four primary objectives:

(a) To supply Soviet industry with secure, cheap, and convenient gaseous and liquid fuels;

(b) To supply crude oil (and minor amounts of natural gas) to their European satellites--thereby supplying a much needed form of energy to these countries, but

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* A recent upward revision of the original goal of 26,000 kilometers.

also making them dependent on the USSR and preventing an alignment with Western sources;

(c) To provide facilities for the export of oil to the Free World with the resultant benefits to the USSR of obtaining much-needed foreign exchange and equipment and providing the ability to disrupt the established Free World industry;

(d) To reduce the present cost of delivering oil and gas to the export market as well as to Soviet industry.

At the present time the USSR is highly dependent on rail transportation to move petroleum. In 1958 about 63 percent of the ton-kilometers of oil freight moved by rail and only 14 percent by pipeline. By 1965 it is planned that these respective shares will be 46 percent and 34 percent.

The savings to the economy which will result from the increased role of pipelines in petroleum freight movement in the USSR can best be illustrated by comparing rail transport costs from Kuybyshev to Klaipeda on the Baltic Sea with estimated pipeline costs over the same route.

At present those amounts of petroleum which are exported from the Baltic bases of Klaipeda and Ventspils are brought in by rail from the Urals-Volga oil fields, a distance of about 2,100 kilometers. The cost of such movement averages about $1.05 per barrel, based on reported average rail freight costs.

It is estimated that the pipeline operating costs, upon completion of the USSR-European Satellite oil pipeline, (and assuming a liberal 13 percent for depreciation and interest) will be only 29 cents per barrel for the movement from Kuybyshev to Klaipeda. These drastic savings over today's costs by rail will, of course, be of great benefit to the Soviet Union. Of additional interest, when the pipeline system is completed, Kuybyshev oil will have about 11,600 kilometers (7,200 miles) shorter tanker haul to the Scandinavian markets of Denmark and Sweden than Persian Gulf production.

The Soviet capability to export increasing quantities of oil depends to a considerable degree on the completion of its pipeline construction goals. The lack of progress during the 1955-60 period cast some doubts on the capability to complete the plan on schedule. Soviet literature continually has emphasized that the lack of progress on their pipelines was caused by failure to meet production goals for steel pipe of all sizes--but particularly large diameter. There now seems little doubt that the essential parts of this program will be completed, in particular the Comecon pipeline, on schedule. This abrupt reversal in trend has been accomplished by resorting to purchases of pipe and other facilities from Western suppliers. In the period 1959-62 the Soviet Union has either purchased or arranged to purchase at least the following amounts of 40-inch diameter pipe:

	(METRIC TONS)
West Germany	680,000
Italy	240,000
Sweden	135,000
TOTAL	1,055,000

With these purchases, the USSR will be able to meet almost 40 percent of their requirements in the Seven Year Plan for 40-inch pipe. Domestic production of 40-inch pipe so far has been only in token quantities.

The Soviet Union has still more grandiose plans for the future. Whereas at the end of 1960 gas and oil pipelines in use totalled 38,800 kilometers, plans call for the installation of more than 250,000 kilometers of pipeline in the 1961-80 period. Of the 250,000 kilometers, 150/170,000 kilometers will be for gas and 80/100,000 kilometers will be for oil. About one-third of the pipe required will be 40, 48, and 56 inches in diameter. The 48 and 56-inch pipe are scheduled for initial use in 1970 and 1975, respectively.

2. Crude Oil and Petroleum Product Pipelines

a. Current and Planned Construction

The very first petroleum pipeline installed in Russia was designed as an export line, to carry kerosene from the refineries at Baku to the Black Sea export base of Batumi. 22/ This line, 883 kilometers in length and 8 inches in diameter, required ten years--1896 to 1906--to construct. The second and third pipelines to Black Sea terminals were built during 1926-30. These were the Groznyy-Tuapse crude oil pipeline and a second crude oil pipeline linking Baku with Batumi. Following completion of the second Baku-Batumi pipeline, the first was converted to the transport of crude oil also. 23/

Since that time, not a single export pipeline has been installed, as emphasis has been given to the development of a system capable of meeting internal transport requirements, to the linking of the oil fields, refineries and consuming centers by pipeline, the most economic and effective means of transport.

As of the end of 1961, approximately 20,000 kilometers of crude and product pipelines were in use. The historical record of installed petroleum pipeline, together with plans for 1965, is given in Table 3-52.

TABLE 3-52

PETROLEUM PIPELINE IN USE IN THE USSR a/
SELECTED YEARS 1913-1961 AND 1965 PLAN

	KILOMETERS	
YEAR	IN USE AT YEAR END	PLACED IN USE DURING YEAR
1913	1,147	-
1940	4,068	-
1950	5,444	-
1955	10,491	-
1956	11,600	109
1957	13,187	1,587
1958	14,461	1,274
1959	16,700	1,239
1960	17,300	600
1961	20,000 b/	2,700
1965 Plan	46,261 c/	

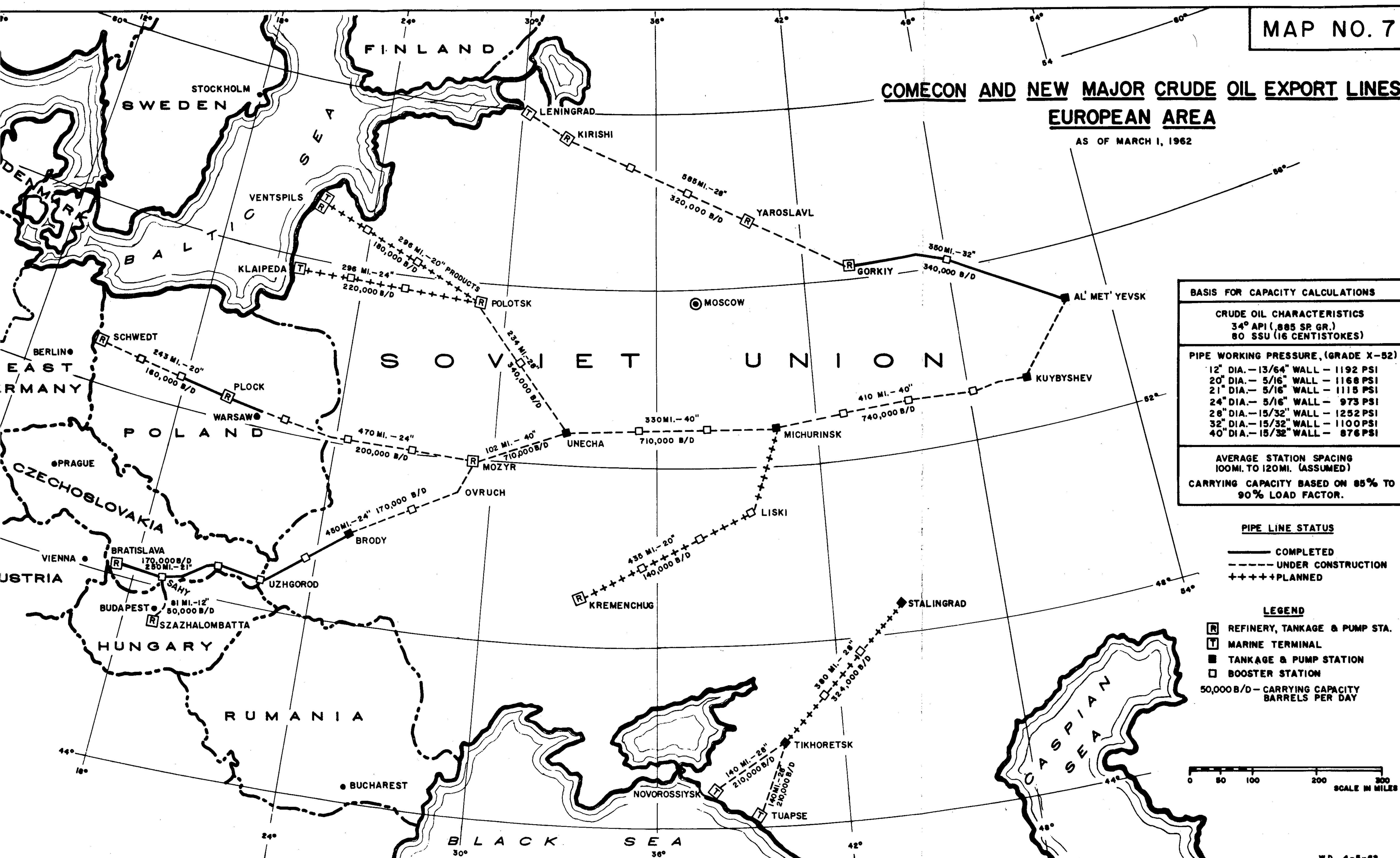
a/ Except where noted, from 24/.
b/ 25/
c/ 26/

The Seven Year Plan calls for the construction during 1959-65 of 31,800 kilometers of crude and products pipeline or more than twice the amount of line that existed at the end of 1958 (14,461 kilometers). The major export systems provided for in this construction program are shown on Map No. 7 and Table 3-53. Detailed below is a description of each major export system and the present construction status.

(1) The USSR-European Satellite (Comecon) Crude Oil Pipeline

The program of construction of the Comecon line, or so-called "Pipeline of Friendship" has been well publicized, largely because the USSR has been forced to turn


COMECON AND NEW MAJOR CRUDE OIL E
EUROPEAN AREA
AS OF MARCH 1, 1962
FINLAND
SWEDEN
STOCKHOLM
DENMARK
BALTIC SEA
LENINGRAD
KIRISHI
585 MI.-28"
320,000 B/D
YAROSLAVL
GORKIY
380 MI.-32"
340,000 B/D
AL' MET' YEVSK
VENTSPILS
296 MI.-20" PRODUCTS
180,000 B/D
KLAIPEDA
296 MI.-24"
220,000 B/D
POLOTSK
MOSCOW
234 MI.-28"
340,000 B/D
WEST GERMANY
EAST GERMANY
BERLIN
SCHWEDT
243 MI.-20"
160,000 B/D
PLOCK
WARSAW
FRANKFURT
POLAND
SOVIET UNION
KUYBYSHEV
410 MI.-40"
740,000 B/D
MICHURINSK
330 MI.-40"
710,000 B/D
UNECHA
102 MI.-40"
710,000 B/D
470 MI.-24"
200,000 B/D
MOZYR
OVRUCH
PRAGUE
CZECHOSLOVAKIA
450 MI.-24" 170,000 B/D
BRODY
LISKI
435 MI.-20"
140,000 B/D
KREMENCHUG
VIENNA
BRATISLAVA
170,000 B/D
250 MI.-21"
SAHY
UZHGOROD
AUSTRIA
BUDAPEST
81 MI.-12"
50,000 B/D
SZAZHALOMBATTA
HUNGARY
STALINGRAD
380 MI.-28"
324,000 B/D
RUMANIA
TIKHORETSK
140 MI.-28"
210,000 B/D
140 MI.-28"
210,000 B/D
NOVOROSSIYSK
TUAPSE
BUCHAREST
BLACK SEA
CASPIAN SEA
BASIS FOR CAPAC
CRUDE OIL C
34° API
80 SSU
PIPE WORKING PR
12" DIA.—13/
20" DIA.— 5/
21" DIA.— 5/
24" DIA.— 5/
28" DIA.—15/
32" DIA.—15/
40" DIA.—15/
AVERAGE ST
100 MI. TO 120
CARRYING CAPACI
90% L
PIPE LI
LE
REFINERY,
MARINE T
TANKAGE
BOOSTER
50,000 B/D — CAP
BA
0 50 100



m Council, 1962, Washington, D. C.

TABLE 3-53

DATA ON OIL EXPORT PIPELINES IN USSR
TO BE COMPLETED DURING 1959-65

I USSR - EUROPEAN SATELLITE CRUDE OIL PIPELINE

ORIGIN	TERMINUS	LENGTH (MILES)	DIAMETER (INCHES)	- COMMITTEE CALCULATIONS - NUMBER OF PUMPING STATIONS	METRIC TONS OF STEEL REQUIRED	MAXIMUM CAPACITY (BARRELS PER DAY)	CARRYING CAPACITY (BARRELS PER DAY)	ESTIMATED INVESTMENT (MILLION DOLLARS)	ESTIMATED OPERATING COST (CENTS PER BARREL)
Kuybyshev (USSR)	Michurinsk (USSR)	410	40"	4	196,800	862,000	740,000	105.8	8.05
Michurinsk (USSR)	Mozyr' (USSR)	430	40"	4	206,400	840,000	710,000	118.9	9.05
Michurinsk (USSR)	Unecha (USSR)	-	-	-	-	-	-	-	6.90
Mozyr' (USSR)	Plock (Poland)	470	24"	4	89,000	238,000	200,000	48.8	12.20
Plock (Poland)	Schwedt (East Germany)	243	20"	3	38,300	185,000	160,000	23.2	8.30
Mozyr' (USSR)	Uzhgorod (USSR)	450	24"	4	85,200	196,000	170,000	45.7	13.00
Uzhgorod (USSR)	Bratislava (Czechoslovakia)	250	21"	3	41,400	196,000	170,000	24.5	8.10
Sahy (Czechoslovakia)	Szazhalombatta (Hungary)	81	12"	1	5,300	55,000	50,000	4.2	4.20
Michurinsk (USSR)	Kremenchug (USSR)	435	20"	4	68,500	167,000	140,000	37.2	13.80
Unecha (USSR)	Polotsk (USSR)	234	28"	2	77,200	392,000	340,000	34.6	5.80
Polotsk (USSR)	Klaipeda (USSR)	296	24"	3	56,100	260,000	220,000	35.9	8.45
Polotsk (USSR)	Ventspils (USSR) (Products line)	296	20"	3	46,600	210,000	180,000	28.7	8.80
		3,595		35	910,800			507.5	

II OTHER USSR CRUDE OIL PIPELINES

ORIGIN	TERMINUS	LENGTH (MILES)	DIAMETER (INCHES)	NUMBER OF PUMPING STATIONS	METRIC TONS OF STEEL REQUIRED	MAXIMUM CAPACITY (BARRELS PER DAY)	CARRYING CAPACITY (BARRELS PER DAY)	ESTIMATED INVESTMENT (MILLION DOLLARS)	ESTIMATED OPERATING COST (CENTS PER BARREL)
Tuymazy	Angarsk (Irkutsk)*	2,300	28"	18	759,500	370,000	320,000	317.8	54.00
Angarsk (Irkutsk)	Nakhodka	2,740	28"	21	904,700	370,000	320,000	376.4	64.00
			If 32"	19	1,052,400	465,000	400,000	462.5	59.30
Al'met'yevsk	Leningrad	935	28"	7	308,730	370,000	320,000	138.8	21.30
Stalingrad	Tikhoretsk	380	28"	3	125,470	378,000	324,000	53.9	9.24
Tikhoretsk	Tuapse and Novorossiysk**	140	28"	1	46,220	245,000	210,000	20.1	3.64

* Classified as an export pipeline in that it would link the proposed Irkutsk - Nakhodka pipeline with the producing fields in the Urals-Volga.

** Data apply to each section.

to Western suppliers of steel pipe and because of the desire to illustrate to the world the cooperation of the nations of the Soviet bloc in matters of mutual concern. This pipeline, designed to link the large Urals-Volga oil fields of the USSR with refineries under construction in Poland, East Germany, Hungary and Czechoslovakia, will also include extensions to the Baltic ports of Klaipeda and Ventspils and, possibly to the Black Sea port of Odessa. In addition, the pipeline is to supply new refineries planned or under construction in the USSR at Mozyr', Polotsk and Kremenchug; and there is some evidence to suggest that a refinery may be constructed at Ventspils. Assuming the availability of the steel pipe and associated pipeline equipment, the entire system probably will be completed for use by 1964. Portions of the system completed prior to 1964, i.e., the Brody-Uzhgorod-Bratislava section and the Sahy-Szazhalombatta pipeline in Hungary which branches off the Brody-Bratislava section, will be filled with crude oil transported to Brody by rail tank car. The Brody-Bratislava section was completed by late 1961; the Sahy-Szazhalombatta section will be finished by mid-1962.

Cognizance of the obvious military significance of this pipeline must be taken. The system, which is being placed underground and camouflaged, will supply crude oil to terminals where there are large concentrations of Soviet or satellite forces, thus making possible the more timely and adequate delivery of fuels to these forces. The oil made available at Klaipeda and Ventspils could be used to fuel war vessels.

Work is to begin in 1962 on the major segment of the system--the 1,350 kilometer link between Kuybyshev and Mozyr'. 27/ This link is to be built of 40-inch pipe, which will mark the first use of such diameter pipe in the construction of an oil pipeline. Reportedly, the 40-inch pipe to be used in construction of the Kuybyshev-Mozyr' portion will be provided by the Taranto, Italy pipe mill, which has gone into production following installation of pipe-making equipment obtained from a U.S. company.

Also in 1962, construction is to begin on the Unecha-Polotsk sector. Thus, together with the Mozyr'-Brest and Mozyr'-Brody sectors, where pipe was being laid in 1961, there are pipeline crews at work along all sectors of the system simultaneously.

Routes and the projected size of various parts of the line were available from published Soviet reports. With this data the capacity of each of the segments of the system line has been calculated by the Committee making certain assumptions. A description of the assumptions and the calculations follows:

The 40-inch diameter crude oil pipeline presently under construction between the Urals-Volga oil fields near Kuybyshev and the town of Michurinsk will have a maximum capacity of 862,000 barrels per day. This is based on the assumption that four pumping stations will be constructed with at least 17,000 horsepower installed at each station. Station spacing for the most economical operation of a 40-inch diameter pipeline should be somewhere between 100 miles and 120 miles. Since the distance between Kuybyshev and Michurinsk is approximately 410 miles, this would dictate that the distance between stations would be 102.5 miles plus or minus any variation to adjust for minor differences in elevation at the proposed station site. The average annual carrying capacity, taking into consideration down time for equipment maintenance, power failure, and malfunctions, will be somewhere between 85 percent and 90 percent of the maximum capacity or in the neighborhood of 740,000 barrels per day.

Future plans call for a 20-inch diameter leg to extend southward from Michurinsk through Liski to Kremenchug. With the lines operating at maximum capacity, it will probably be necessary to install break-out tankage at Michurinsk in order to handle this movement. The maximum capacity of this 20-inch diameter line with four pumping stations of 4,500 horsepower each will be 167,000 barrels per day. The average annual carrying capacity will be approximately 140,000 barrels per day.

The 40-inch diameter trunk line will continue westward from Michurinsk through Unecha to a tank farm and refinery at Mozyr'. The maximum capacity of this section of line with pump station spacing of approximately 110 miles will be 840,000 barrels per day and average annual carrying capacity estimated at 710,000 barrels per day.

Crude oil can be stripped out of the 40-inch or delivered directly into break-out tankage at Unecha and pumped through a 28-inch diameter line to a refinery near Polotsk. The maximum capacity of this line with one 11,500 horsepower booster station will be 392,000 barrels per day. The average annual carrying capacity will be in the neighborhood of 34,000 barrels per day.

In the planning stage are two pipelines extending westward from Polotsk to the Baltic Sea. A 24-inch diameter line will be constructed to a marine terminal at Klaipeda and provide means for exporting up to 220,000 barrels per day of crude oil to western Europe. The other proposed line would be used to transport finished products from the Polotsk refinery to a marine terminal at Ventspils, thence for export to western Europe. It will probably be a 20-inch diameter line and have an annual average capacity of 180,000 barrels per day.

Extending westward from the end of the 40-inch diameter trunk line at Mozyr' will be two 24-inch diameter lines, one supplying refineries in Poland and East Germany and the other, refineries in Hungary and Czechoslovakia. The northern line will enter Poland at Brest and tie into a line recently completed from the Warsaw area to a refinery at Plock. This section will be 24-inch diameter and with four 5,250 horsepower pumping stations be able to handle approximately 200,000 barrels per day. A 20-inch diameter line is partially completed between Plock and Schwedt located near the East Germany border. The average annual capacity of this section with three 5,000 horsepower pumping stations located approximately 81 miles apart will be over 160,000 barrels per day.

The 24-inch diameter line presently under construction between Mozyr' and Brody will tie into a pipeline already in operation supplying a refinery in Bratislava, Czechoslovakia. This line runs over the Carpathian Mountains near the Czechoslovakian border and from Uzhgorod to Bratislava (21-inch diameter). The capacity of the 24-inch line between Mozyr' and Uzhgorod is reduced because of the energy required to overcome the approximately 3,500 foot differential in elevation to permit flow over the mountain range. The maximum capacity of this line is 196,000 barrels per day, the average annual capacity being approximately 170,000 barrels per day. A 12-inch diameter leg is partially constructed between Sahy, Czechoslovakia and Szazhalombatta, Hungary, which will be capable of a gravity flow in excess of 35,000 barrels per day. A 700 horsepower booster station at Sahy will permit deliveries to the Szazhalombatta refinery in excess of 50,000 barrels per day.

With a few exceptions, which may be explained by some additional information, the Comecon System appears to be well designed. The combined flow in all the branch lines is approximately equal to the quantity which can be supplied by the main trunk line from the oil field. A deviation from the optimum station spacing could change slightly the capacity to any particular location if this proved necessary.

(2) Urals-Volga (Al'met'yevsk)-Leningrad Crude Oil Pipeline

Although work was not begun until the Spring of 1961, more than one-third of this 1,500 kilometer crude oil pipeline already has been completed. If current construction rates are maintained, this pipeline will be completed to Leningrad by early 1963. It is estimated that this pipeline has a diameter of 28-inches, which would indicate a maximum carrying capacity of 18.5 million tons per year or 370,000 barrels per day.

In addition to supplying crude oil to refineries planned or under construction at Gor'kiy, Yaroslavl' and Kirishi, completion of the pipeline to Leningrad should greatly augment the capability of the USSR to export petroleum, particularly to Northern Europe and the Scandinavian countries.

(3) Stalingrad-Tikhoretsk-Tuapse and Tikhoretsk-Novorossiysk Crude Oil Pipeline

Work has begun on the Tikhoretsk-Tuapse and Tikhoretsk-Novorossiysk sections and the entire system is to be completed by 1965. This pipeline, insofar as is known, is to be used for increasing deliveries of crude oil to the Black Sea export bases of Tuapse and Novorossiysk, and will have an estimated maximum carrying capacity of 378,000 barrels per day or 18.9 million tons per year.

(4) The Tuymazy-Irkutsk Crude Oil Pipeline

This line, which is now under construction, will be 28-inches in diameter and though originally scheduled for completion in 1960, will probably be finished in early 1963. This line has been delayed by the difficult terrain and climate. Maximum carrying capacity of the line will be 370,000 barrels per day.

(5) Irkutsk-Nakhodka Crude Oil Pipeline

Should the USSR and Japan reach mutually agreeable terms with respect to the barter of Soviet oil for Japanese steel pipe, construction of a crude oil pipeline between Irkutsk and Nakhodka, a distance of about 4,400 kilometers, will be undertaken. It has been reported that the USSR is seeking 650,000 tons of 28-inch pipe, valued at $U.S. 150 million, for this project. This line would link Irkutsk and the Pacific Ocean port of Nakhodka, located about 100 kilometers east of Vladivostok. Maximum carrying capacity of the Irkutsk-Nakhodka pipeline would be about 375,000 barrels per day and, after considering withdrawals from the pipeline to meet the indigenous needs of the Soviet Far East, could provide for the export from Nakhodka of as much as 200,000 barrels per day. Crude would be delivered to the Irkutsk-Nakhodka pipeline through the Tuymazy-Irkutsk line now under construction. In view of the difficulties of logistics, terrain and climate, it is doubtful whether the pipeline to Nakhodka could be completed in less than five years.

As shown on Table 3-53, the pipeline cost of delivering oil from Tuymazy to Nakhodka has been estimated to be about $1.18 per barrel. The USSR could deliver comparable amounts of oil to Nakhodka by tanker for an estimated $1.15 per barrel (assuming pipeline from the producing area to Tuapse and by owned tanker, 47,000 ton class, to Nakhodka through the Suez Canal). Thus, in that pipeline transport of oil to Nakhodka does not represent the cheapest means, construction of the Irkutsk-Nakhodka pipeline implies a greater benefit to meeting the petroleum demand of the Soviet Far East and to national security in general.

(6) Other (Okha-Komsomol'sk Crude Oil Pipeline and Baku-Batumi Product Pipeline)

In addition to the major oil export pipelines which have been discussed, there are two other pipelines, under construction or planned, which ultimately may have an effect on the petroleum export capability. Construction of a parallel Okha (Sakhalin)-Komsomol'sk crude oil pipeline reportedly is under way.[28] Ultimately the USSR may extend this pipeline southward to connect with the proposed Irkutsk-Nakhodka pipeline. If so, crude oil could move north along this system and would free Sakhalin crude oil for export.

Finally, mention has been made in the Soviet press on several occasions of another Baku-Batumi pipeline. The growth in extraction of natural gas and the recent creation of a gas transmission system in the Caucasus undoubtedly has reduced the requirements in this area for petroleum products. This displacement, coupled with the steady but unspectacular growth in the production of crude oil in this region, would support the construction of another pipeline and of its use to carry petroleum products to Batumi for export. Soviet press statements are ambiguous as to whether this second Baku-Batumi product pipeline is actually under construction or is only planned for construction. [29]

b. Estimated Investment and Operating Costs

A summary of investment and operating costs of the USSR-European Satellite Crude Oil Pipeline and of other new export systems is to be found in Table 3-53, above. Detailed calculations of investments are given in Appendix A; calculations of operating costs are given in Appendix B. These are not investments and costs as reported by the USSR, rather they are estimates made by the study committee. The pipeline investment costs are based on using pipe from European mills and over-seas pipeline construction costs. No provision was made for right-of-way costs or payment of construction damages. The pumping station costs at $300/HP are higher than would normally be estimated; however, they were based on minimum horsepower requirements for the maximum pipeline flow with no provision for standby units or communication facilities. Breakout tankage at points where receipts or deliveries are to be made are sized to contain approximately two-days supply at the maximum flow rate. At marine terminals, a five-day supply was provided. Indirect costs and contingency are made up of engineering, purchasing, expediting and inspection costs prior to and during construction and numerous small items which are difficult to tie down in an estimate.

The operating costs are figured on the basis of semi-automatic electric stations with man power on duty at all times. Energy charges are based on power at $.02 per kilowatt-hour. The major portion of operating expense is made up of interest on the investment capital at six percent per annum and depreciation charges which recover the invested capital over a ten-year period. All cost-per-barrel figures are based on the pipeline operating at the maximum carrying capacity. Operations at less than this throughput would result in higher unit costs, the only reduction in operating costs being in power consumption.

c. Construction Performance

The Soviet Union has experienced considerable difficulty in the postwar period in the construction of crude oil and petroleum product pipelines. For the years 1951-61, petroleum pipeline construction goals were missed by 20 percent as actual installation totalled only 15,862 kilometers, compared with a plan of 19,908 kilometers. As noted in Figure No. 9, however, the performance in the first three years of the Seven Year Plan has very nearly matched the plan goals.* Yet the possibility that the USSR can complete its oil pipeline construction program for 1959-65 is not certain, although performance has improved considerably in recent years. To meet this program calls for a relatively sharp growth in oil pipeline construction in 1964 and 1965. The construction planned for these two years very nearly equals total oil pipeline construction during the ten-year period 1951-61. Again, the possibility that the construction goals for these later years may be met probably depends upon the availability of steel pipe in the required assortment of sizes.

Most of the lag encountered in the construction of oil pipeline, particularly after 1955, can be traced to an inadequate supply of steel pipe and to a desire to expand at a rapid rate the natural gas transmission system. Under the forced construction of gas pipelines, the oil program began to lag behind. Pipeline construction goals were revised to reflect the priority given to the expansion of the gas transmission network. The original goals for the Sixth Five Year Plan (1956-60) called for the construction of 14,500 kilometers of oil pipeline and 9,000 kilometers of gas pipeline. Within 18 months after publication of these plans, the goal for oil pipelines was reduced by about 28 percent, to 10,500 kilometers. 30/

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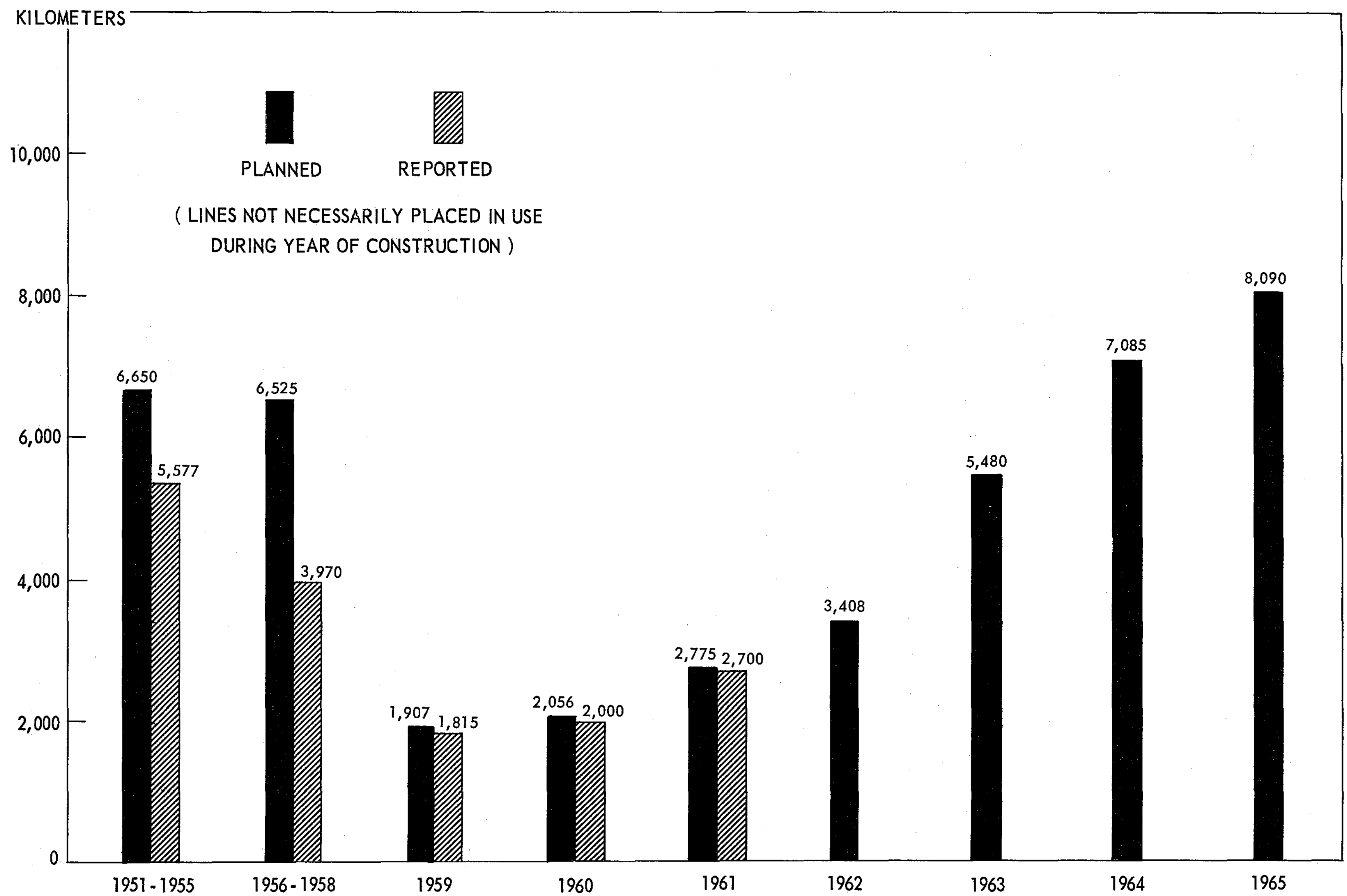
* Reported distances constructed are not necessarily placed in use during the year, hence Figure No. 9 and Table 3-52 are not comparable.

Figure No. 9

PLANNED AND REPORTED CONSTRUCTION OF PETROLEUM PIPELINES IN THE USSR 1951-1965



At the same time, the plan for gas pipeline construction was revised upward, to 16,000 kilometers. Even under the reduced goal, progress in the installation of oil pipeline was completely unsatisfactory. The abandonment of the Sixth Five Year Plan at the end of 1958 should have brought about a more reasonable assessment of pipe-laying capabilities, in that oil pipeline construction during 1956-58 totalled only 3,970 kilometers, compared with a plan for these years of 6,525 kilometers, but such was not the case. It was not until 1961 that the Soviet planners attempted to re-define the priorities attached to oil and gas pipeline construction, and to bring about a more balanced program. In that year the volume of gas pipeline construction was reduced to 3,400 kilometers which was about 85 percent of the 1960 level, while that for oil was increased by 40 percent, to 2,775 kilometers.

Nevertheless, the emphasis given to gas pipeline construction during these years has resulted in the installation of a gas transmission system which in 1961 exceeded in length the oil pipeline network by 25 percent.

Petroleum pipelines in use, under construction and planned for construction are shown on Map No. 8.

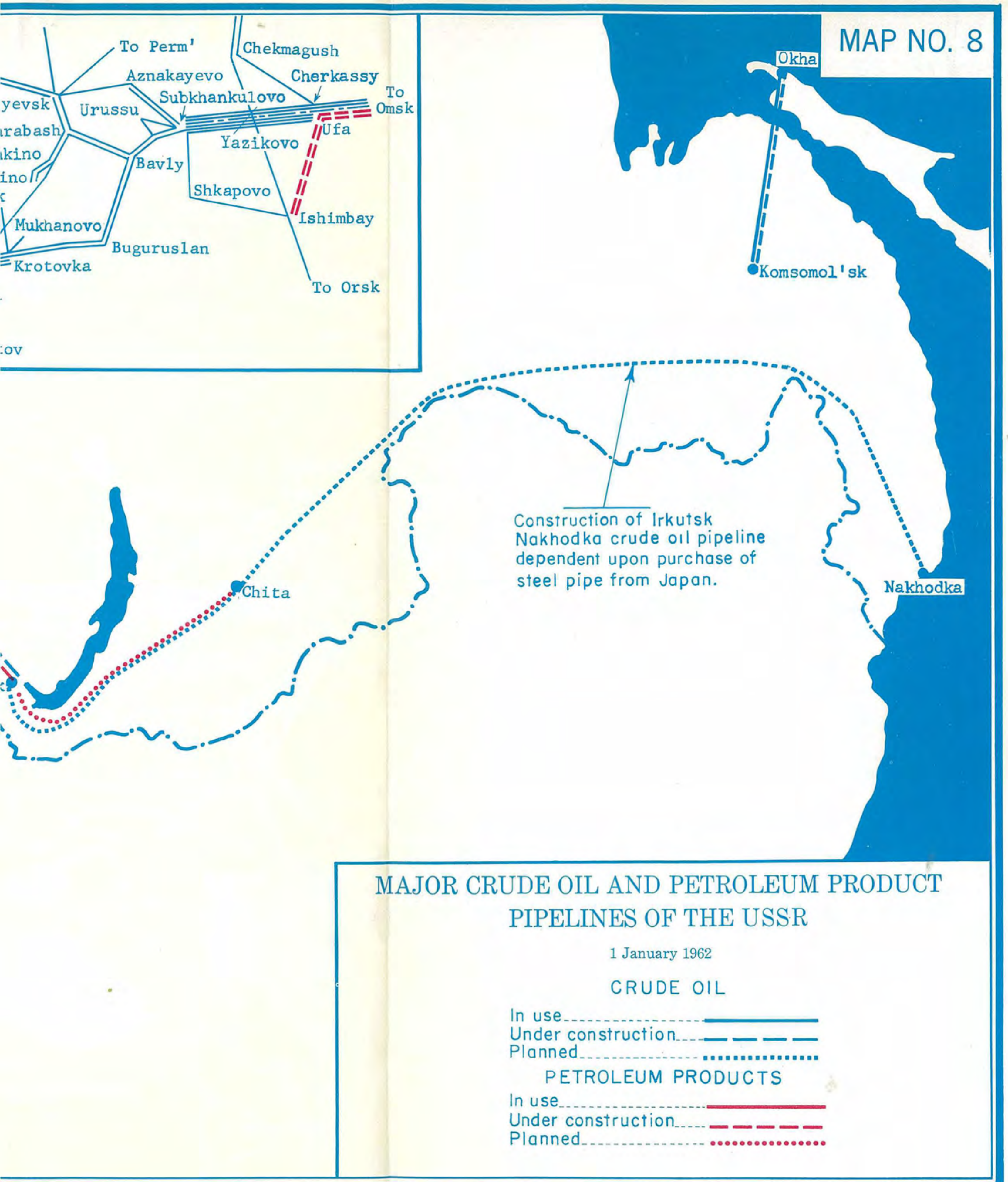
3. Natural Gas

a. Current and Planned Construction

The first gas pipeline in the USSR was constructed in 1940. It was designed to supply gas to Makhach-Kala and was 65 kilometers in length. What could be termed the first major transmission gas pipeline in the USSR was built during 1944-46 of 12-inch pipe and is still used to transport gas from the Saratov deposits to Moscow. About seven years lapsed before the second major natural gas line--Dashava-Kiev-Bryansk-Moscow--was completed in 1953. The next major natural gas pipeline effort was the construction in 1956 in a period of nine months of a 28-inch, 1,300 kilometer line for the supplying of Moscow consumers with gas from the Stavropol'deposits in North Caucasus. Installation of this pipeline was the first gas pipeline project to benefit from the program established to allow for sharp growths in the extraction of natural gas.

Since that time, the length of the gas pipeline network has more than tripled, from 7,920 kilometers available in 1956 to an estimated 25,000 kilometers in 1961. 31/ Although the

To Gor'kiy
Al'met'ye
Kar
Romashki
Klyavlin
Krasnyy Yar
Sergiyevsk
Yablonovyy
Syzran'
Kuybyshev
Pokrovka
To Sarato
Tebuk
Ukhta
Voy-Vozh
Leningrad
Kirishi
Pibanshur
Perm'
Ventspils
Yaroslavl'
Klaipeda
Gor'kiy
Kazan'
Polotsk
Moscow
Kaltasy
UFA
Krasnoyarsk
Omsk
Ryazan'
Novosibirsk
Schwedt
Bryansk
Petropavlovsk
Plock
Ishimbay
Brest
Unecha
Michurinsk
Kuybyshev
Mozyr'
Zhirnoye
Saratov
Pavlodar
Irkutsk
Liski
Brody
Atbasar
Sahy
Bratislava
Kremenchug
Uzhgorod
Stalingrad
Orsk
Kupyansk
Shungay
Zazhalombatta
Trudovaya
Chaplino
Gur'yev
Koschagyl
Astrakhan'
Munay-li
Tikhoretskaya
Karaton
Novorossiysk
Ozek-Suat
Tuapse
Makhach-Kala
Groznyy
Izberbash
Batumi
Baku
Mayli-Su
Assake
Vannovskaya
Krasnovodsk
Belek
Kum-Dag



MAJOR CRUDE OIL AND PETROLEUM PRODUCT PIPELINES OF THE USSR

1 January 1962

Seven Year Plan calls for the installation of more kilometers of oil pipeline (31,800 kilometers) than of gas (29,500 kilometers) it is doubtful whether the length of the oil pipeline network will, beyond this point, exceed the gas pipeline system. The Twenty Year Plan, covering 1961-80, calls for the installation of about 2 kilometers of gas pipeline for every kilometer of oil pipeline during these years.

The length of the transmission gas pipeline system of the USSR for selected years 1940-65 is given in Table 3-54, and a historical comparison of the lengths of the Soviet oil and gas pipeline systems is presented in Figure No. 10.

Those gas pipelines in use, under construction and planned for construction are shown on Map No. 9.

TABLE 3-54

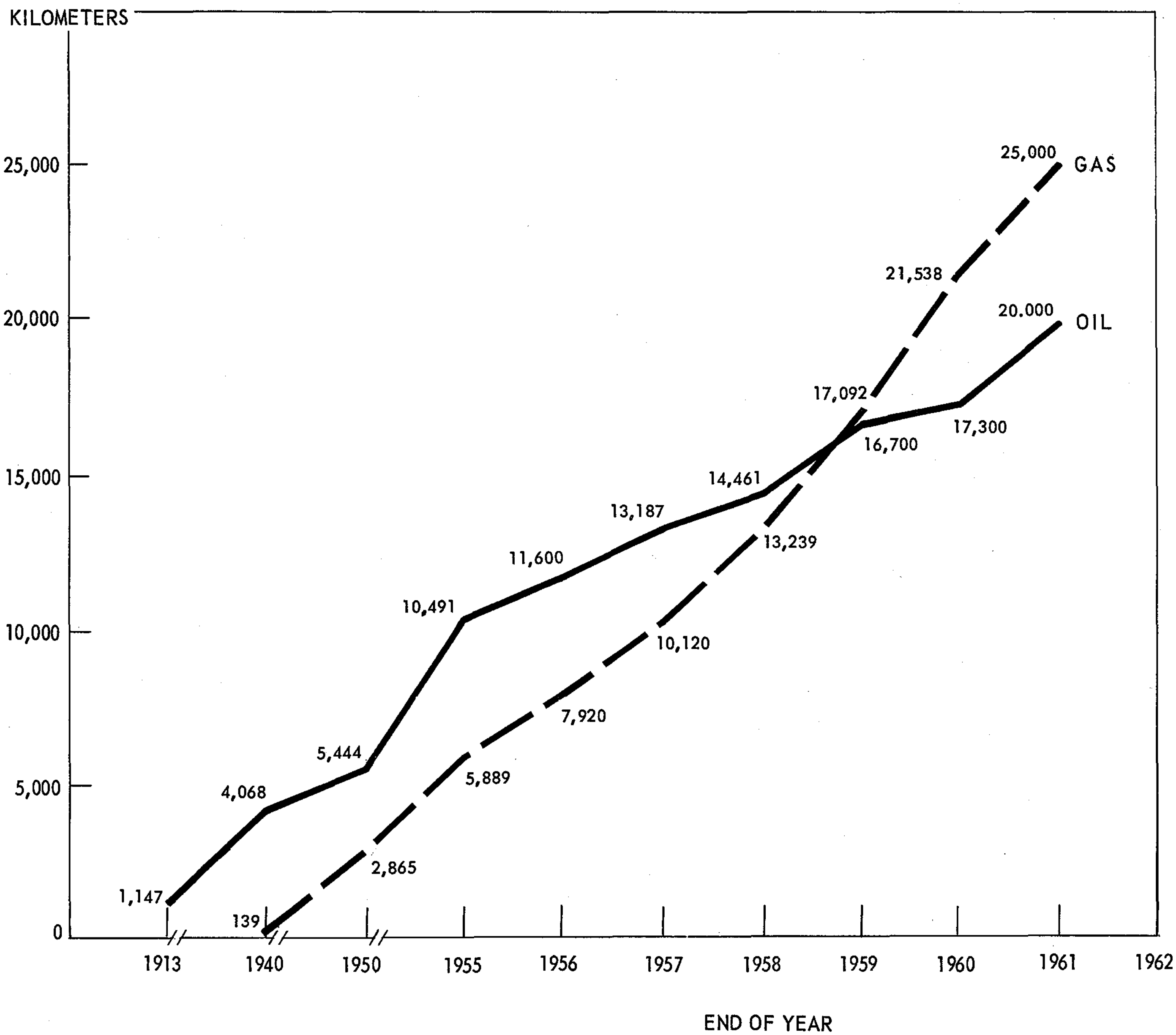
TRANSMISSION GAS PIPELINES IN USE IN USSR a/
SELECTED YEARS 1940-1965*

YEAR	KILOMETERS
1940	139
1949 b/	2,273
1950	2,865
1954 b/	4,279
1955	5,889
1956	7,920
1957	10,120
1958 c/	13,239
1959	17,092
1960	21,538
1961 Plan	25,266
1961 Reported d/	25,000
1965 Original Plan	39,267
1965 Revised e/	42,762

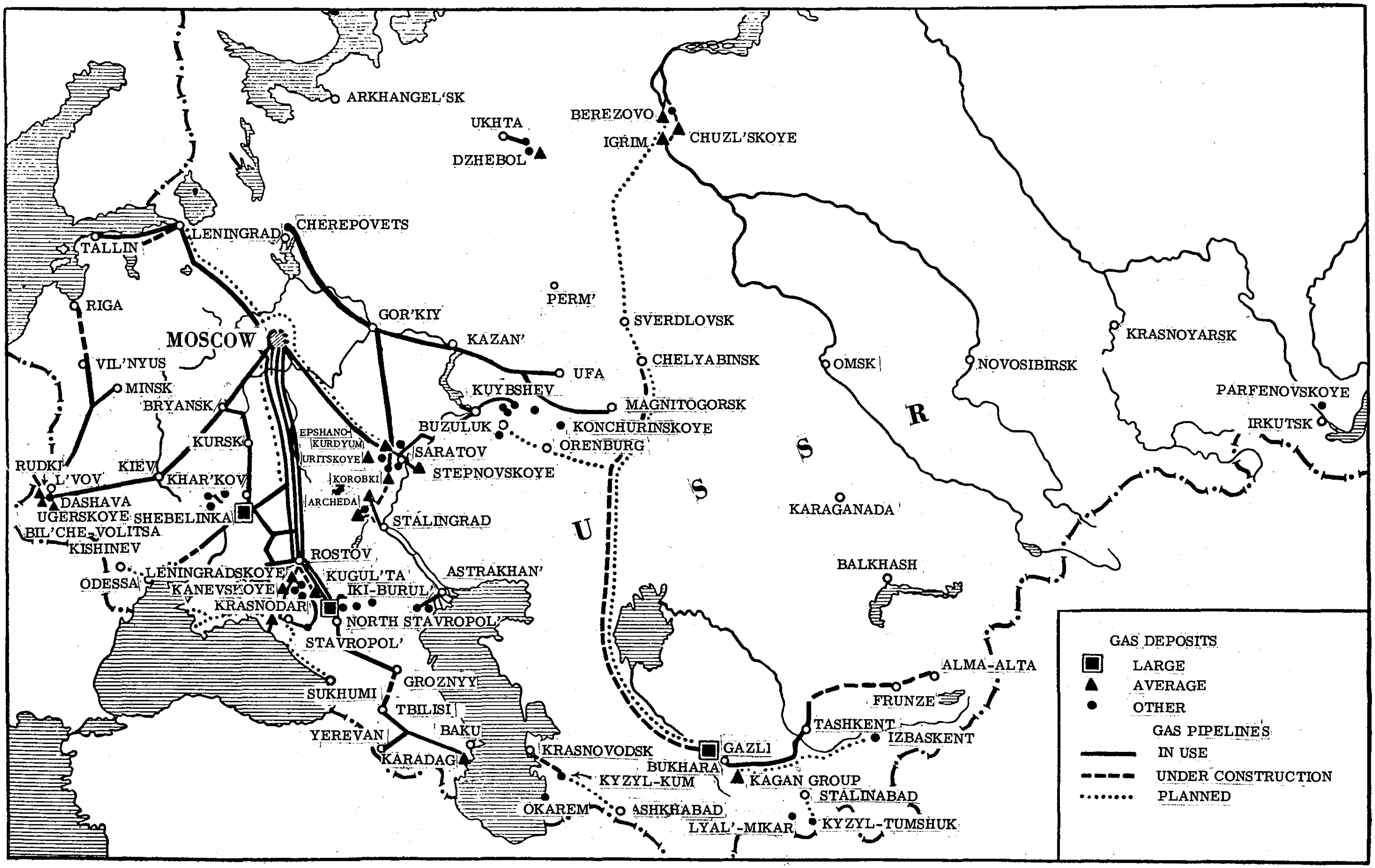
* Includes those pipelines used for the transport of manufactured gas.
a/ Except where noted, from 32/.
b/ 33/
c/ 34/
d/ 35/
e/ 36/

Figure No. 10

OIL AND GAS PIPELINES IN USE IN THE USSR



MAP NO. 9



TRANSMISSION GAS PIPELINES OF THE U.S.S.R., 1961

Within the USSR, there are presently six major flows of natural gas. These are:

(a) From the Stavropol' and Krasnodar Kray deposits in the North Caucasus to the major consuming centers of Moscow, Leningrad and the Donbas;

(b) From the Dashava deposits in the Western Ukraine to consumers enroute to Moscow and to consumers in Belorussia and the Baltic area;

(c) From the Shebelinka deposits in the Eastern Ukraine to the Donbas and to Moscow and Leningrad;

(d) From the Saratov, Stalingrad and Kuybyshev fields to consumers within the Volga region and northwest to Yaroslavl' and Cherepovets';

(e) From the Karadag fields in Azerbaydzhan for consumption within the republic and to consumers in Georgia and Armenia;

(f) From the Gazli-Kagan group in Uzbekistan eastward to supply other Central Asian republics.

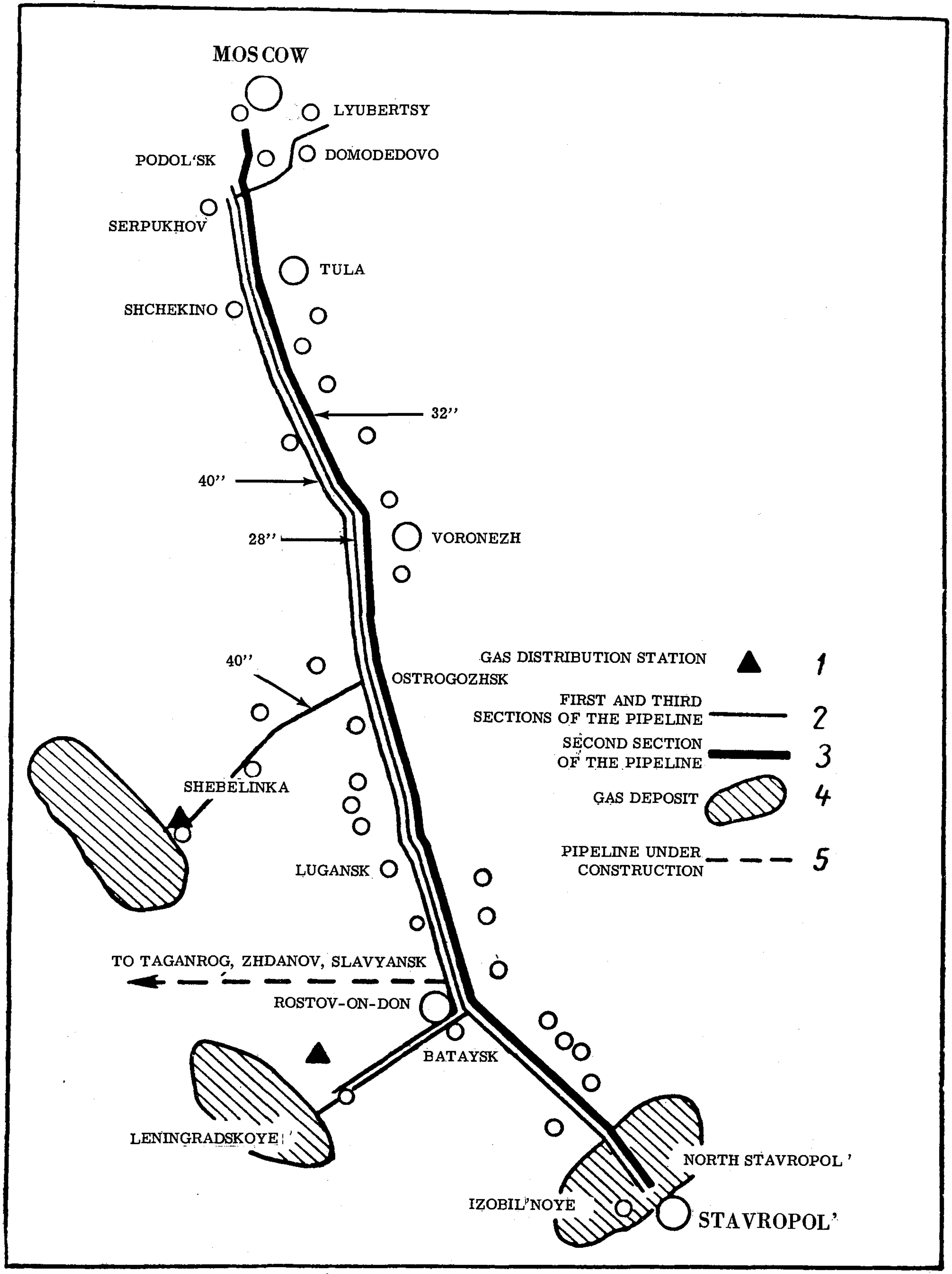
Of these, the flow of most current significance to the national economy is that through the Stavropol'-Moscow and Krasnodar Kray-Serpukhov (south of Moscow) systems. (See Map No. 10) The Stavropol'-Moscow system is made up of two parallel pipelines, the first constructed in 1956 of 28-inch pipe and the second completed in 1958, using 32-inch pipe. The Krasnodar Kray-Serpukhov system, which draws upon gas from the Leningrad-skoye deposit in Krasnodar Kray, was laid in 1959-61, using 40-inch pipe imported from West Germany. West German 40-inch pipe was also used to connect the Shebelinka deposit in the Eastern Ukraine with the latter system.

Current plans call for the following major construction:

(a) A 40-inch gas pipeline to parallel the Krasnodar Kray-Serpukhov system between Ostrogozhsk and Serpukhov. This system also provides gas for transmission further to the northwest to Leningrad.

(b) The so-called Moscow outer gas ring, a 500 kilometer, 32-inch system which is to supply the

MAP NO. 10

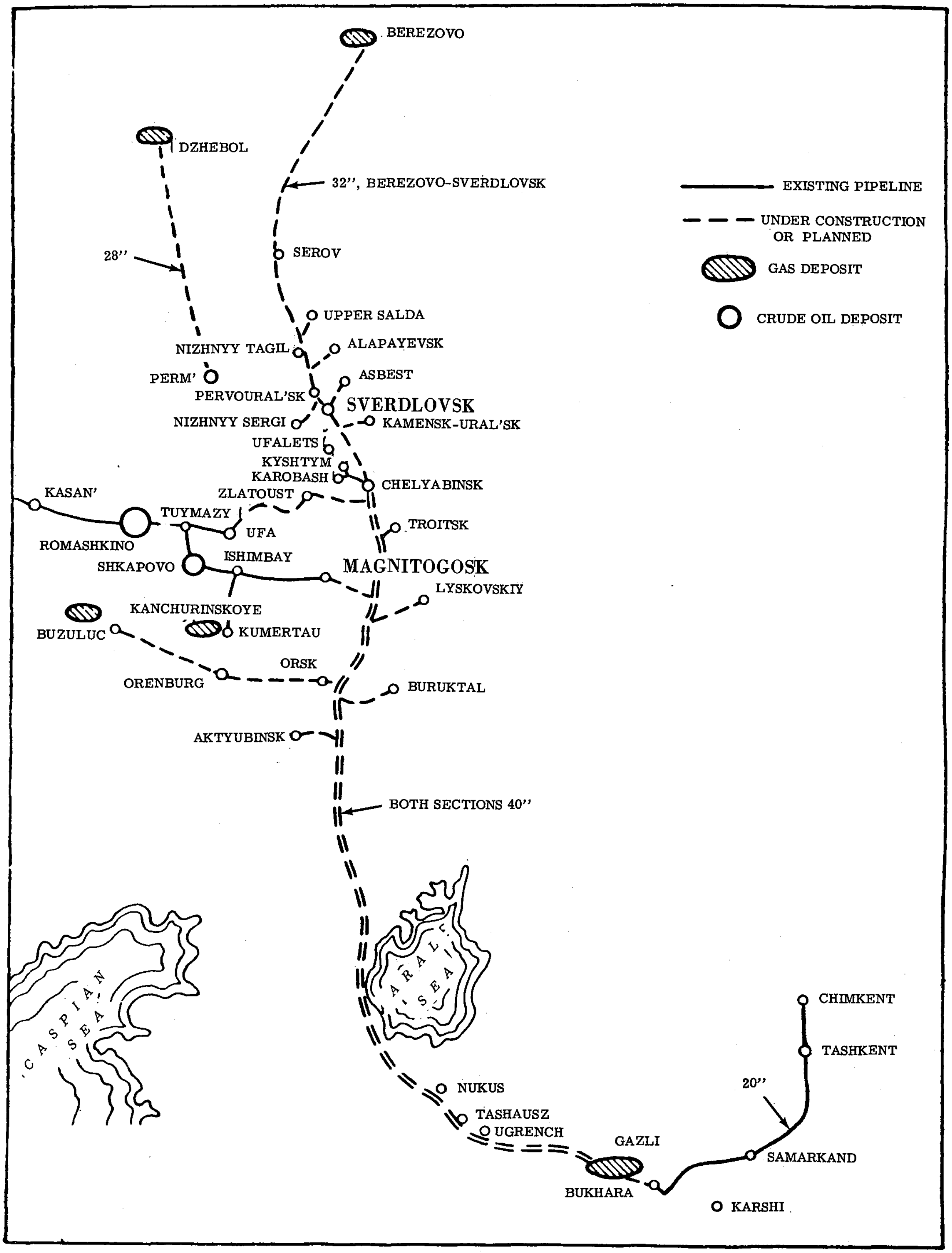


THE STAVROPOL'-MOSCOW AND KRASNODAR KRAY-ROSTOV ON DON-LUGANSK-SERPUKHOV GAS PIPELINE SYSTEMS metropolitan area of the Moscow Oblast with natural gas. 37/ The ring is scheduled for completion in 1962. (This ring augments a 120 kilometer, 28-inch inner gas ring, completed in 1959 to serve Moscow and its suburbs.) Another 500 kilometers of branch pipelines leading off this ring will be laid as will 2,500 kilometers of city distribution systems. Some 3.5 million people in the Moscow region will be provided gas upon completion of the Moscow gas ring. The Stavropol'-Moscow, Krasnodar Kray-Serpukhov, Saratov-Moscow, and Dashava-Moscow gas pipelines will feed this ring.

(c) Initial installations of about 150 kilometers of 40-inch pipe were made in 1961 on what reportedly will be the world's largest transmission gas pipeline upon completion of all segments in 1965. This pipeline, as shown on Map No. 11, is designed to transport natural gas from the Gazli deposit in Uzbekistan to consumers in Chelyabinsk and Sverdlovsk, in addition to others enroute, and is to be constructed in two sections or parallel lines. The first section, Gazli-Chelyabinsk, will be 1,967 kilometers in length and, according to plan, is to be completed in 1963. Current scheduling calls for about 1,000 kilometers of pipe to be laid along this trace in 1962. The second section, from Gazli to Sverdlovsk, length of 2,163 kilometers, is to be completed for use by 1965, as is a 334 kilometer parallel section between Chelyabinsk and Sverdlovsk. 38/ Thus, the dual Gazli-Ural gas pipeline system will total 4,464 kilometers in length, and with all 17 planned compressor stations in place, will have an annual throughput capacity of 21 billion cubic meters. Use of 40-inch pipe is planned for the entire 4,464 kilometers, which will require more than 1.3 million tons of steel (300 tons per kilometer). The cost of the system will be in excess of 500 million (new) rubles.

Planned delivery of natural gas through this system in 1965 is to exceed 19 billion cubic meters. Of this volume, only 5 percent has been allocated to meet the so-called communal needs of the 33 cities which will be tied into the system. The remaining 95 percent is to be used for industrial purposes, primarily in the production of steel.

MAP NO. 11



PLANS FOR SUPPLYING OF NATURAL GAS TO THE URALS

TABLE 3-55

PLANNED CONSUMPTION OF NATURAL GAS TO BE TRANSPORTED BY THE GAZLI-URAL SYSTEM a/ - 1965

CONSUMER	BILLION CUBIC METERS	PERCENT OF TOTAL
Communal needs of 33 cities	1.0	5.2
Industry		
Blast Furnaces	3.4	17.7
Martin Furnaces	3.6	18.8
Light Metallurgy	2.4	12.5
Chemical Industry	0.9	4.7
Consumed in Industrial Boilers	2.8	14.6
Other	5.1	26.5
TOTAL	19.2	100.0

a/ 39/

(d) The Gazli deposit in Uzbekistan is not to be the only source of supply of gas to industrial centers in the Urals. As shown on Map No. 11, plans call for the construction of a 900 kilometer, 32-inch pipeline to carry gas from the Berezovo deposits, located on the Ob' River, to consumers in Sverdlovsk. Another line, 460 kilometers in length and 28-inches in diameter, is to allow delivery of gas from the Dzhebol' deposit in the Komi ASSR to Perm'. No construction date has been set for either of these pipelines and it may be that the current level of proved reserves at the Dzhebol' and Berezovo deposits do not warrant major pipeline construction at this time. A comparison of the Gazli-Ural, Berezovo-Sverdlovsk and Dzhebol-Perm' gas pipelines is given in Table 3-56.

TABLE 3-56

A COMPARISON OF GAS PIPELINES PLANNED FOR THE SUPPLYING OF NATURAL GAS TO THE URALS a/

PIPELINE ORIGIN	PIPELINE TERMINUS	DIAMETER (INCHES)	LENGTH (KILOMETERS)	CAPACITY (BILLION CUBIC METERS)	COST (MILLION RUBLES)	STEEL PIPE (THOUSAND METRIC TONS)
Gazli	Urals (Chelyabinsk and Sverdlovsk)	40	4,130 b/	21.0	504.0	1,240
Berezovo	Sverdlovsk	32	900	6.5	124.0	180
Dzhebol	Perm'	28	460	4.5	30.5	75

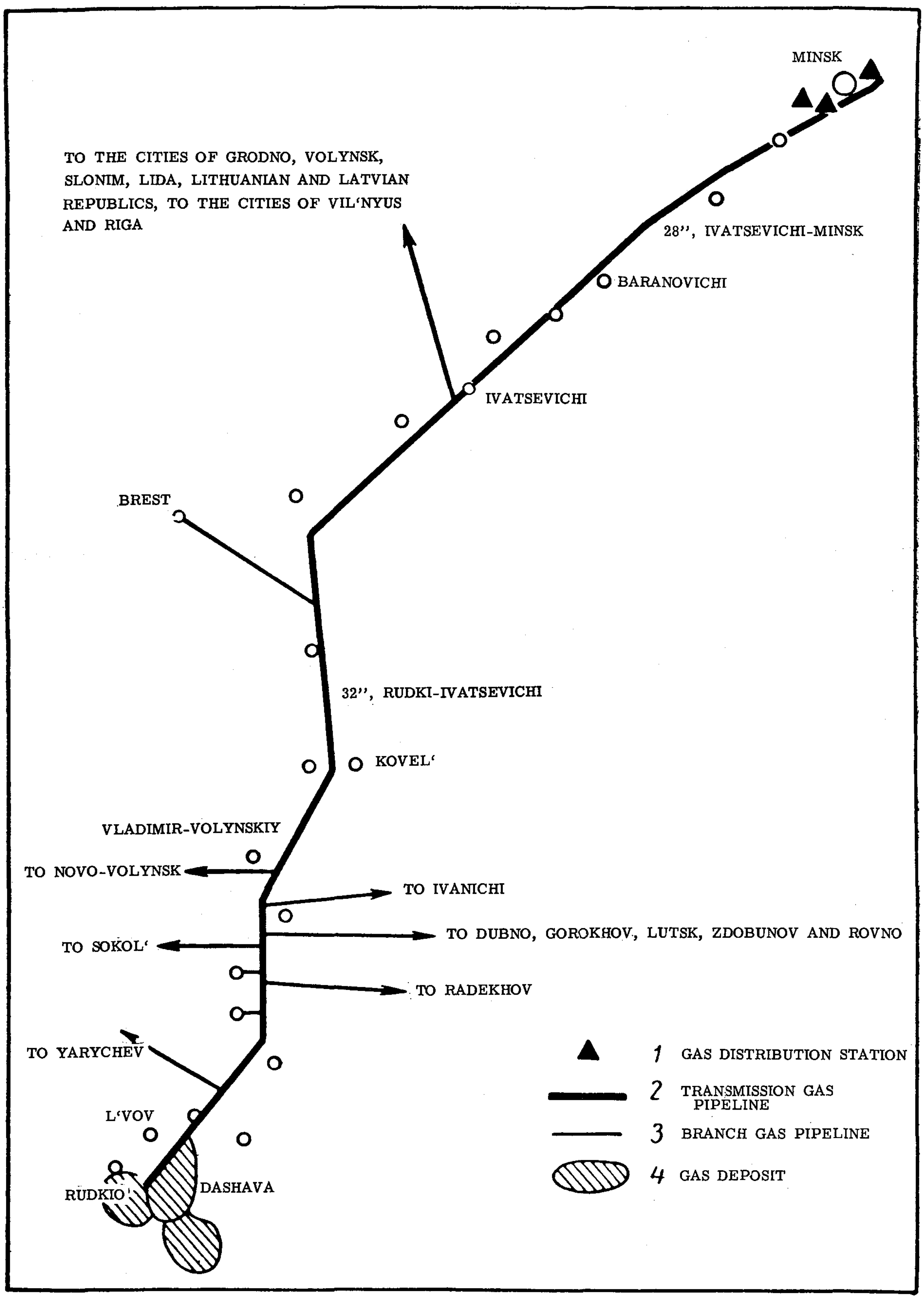
a/ After 40/.
b/ Excluding looping between Chelyabinsk and Sverdlovsk.

(e) Of particular importance to the Baltic republics of the USSR is the current construction of a pipeline which, when completed, will supply consumers in that area, as well as the fuels-deficient regions of northwest Ukraine, with natural gas from the Dashava deposit in the Western Ukraine. The Dashava-Minsk section of this pipeline is shown on Map No. 12. The section to Minsk has been completed and installation is under way on the branch line to Vil'nyus and Riga. Originally, the pipeline was to have been extended beyond Minsk, to Leningrad, but a recalculation of the reserves of natural gas at Dashava fields forced abandonment of this plan.

b. Performance of Natural Gas Lines

A major problem in the successful operation of transmission gas pipelines in the Soviet Union has been the failure to develop a compressor adequate for use on large diameter pipelines. This failure has resulted in a number of pipelines such as the Saratov-Moscow line and the Stavropol'-Moscow system being placed in initial service without any compressor stations. Moreover, because of the resultant shortage of installed compressor capacity, many of the major pipelines are utilized at levels well below the rated capacity. Among these lines are included the dual Stavropol'-Moscow system, Dashava-Minsk and Saratov-Gor'kiy.

MAP NO. 12



THE DASHAVA-MINSK GAS PIPELINE

Finally, the failure to develop a satisfactory compressor has contributed to the recent shortfalls in the production of natural gas. The inability to meet the 1960 goal for extraction of natural gas was attributed in part to the lag in installation of compressor stations on the Stavropol'-Moscow pipeline which in turn derived from a lag in the manufacture of gas-turbine units. 41/

In addition to contributing to failures to meet annual extraction goals, the shortcomings in compressor manufacture and installation have kept the costs of transportation of natural gas at much higher levels than anticipated, although a general downward trend in transportation costs has been achieved in recent years, as illustrated in Table 3-57.

TABLE 3-57

REPORTED AVERAGE COST OF TRANSPORT OF NATURAL GAS IN THE SOVIET UNION 1956 - 1960

YEAR	RUBLES/1,000 CUBIC METERS
1956	2.93 a/
1957	2.48 a/
1958	2.14 a/
1959	2.28 a/
1960	2.20 b/

a/ 42/
b/ 43/

Within this national average, costs of transport of natural gas vary widely within the USSR, as shown in Table 3-58.

4. Steel Pipe Requirements, 1959-65

a. Demand for Steel Pipe

It is estimated that about 9.5 million tons of steel line pipe will be needed to complete the construction of the

TABLE 3-58

REPORTED COSTS OF TRANSPORT OF NATURAL GAS IN THE USSR FOR SELECTED PIPELINES

GAS PIPELINE ORIGIN	GAS PIPELINE TERMINUS	COST OF TRANSPORT (RUBLES/1,000 CUBIC METERS)	DIAMETER (INCHES)	KILOMETERS	RUBLES/KILOMETERS 1,000 CUBIC METERS
Saratov	Moscow	5.50 a/	12	843	0.0060
Dashava	Kiev	2.80 a/	20	550	0.0050
Stavropol'	Moscow	1.30 b/	32	1,300	0.0010
Krasnodar Kray	Serpukhov	1.63 c/	40	1,003	0.0016
Dashava	Minsk	1.19 c/	32 - 28	662	0.0018

a/ 44/
b/ 45/
c/ 46/

29,500 kilometers of gas pipeline and 31,800 kilometers of trunk crude oil and petroleum product pipelines which have been planned for 1959-65. Of the total of about 61,300 kilometers of oil and gas pipeline scheduled for completion during 1959-65, an estimated 8,068 kilometers or more than 13 percent, are to be built using 40-inch pipe. Excluded from these totals is the 4,400 kilometers of crude oil line from Irkutsk to the Pacific Ocean port of Nakhodka. The construction of this pipeline is dependent apparently upon the purchase of about 650,000 tons of 28-inch pipe from Japan. Negotiations for the pipe are still continuing between the USSR and Japan. The Soviet Union does not consider this pipeline to be a part of the Seven Year Plan.

For the installation of gathering lines at the oil and gas fields and for the construction of gas distribution systems in cities and industrial centers, an additional 4 million tons of pipe are required. 47/ Of this quantity, perhaps as much as 1 million tons may be considered to be of large diameter, (i.e., 17 inches or above).

Thus, total requirements for large diameter pipe during 1959-65 may approach 10.5 million tons, excluding pipe requirements for the Irkutsk-Nakhodka pipeline.

The requirements for line pipe can be summarized as follows:

DIAMETER (INCHES)	(MILLION METRIC TONS) TRUNK PIPELINES*	OIL & GAS GATHERING PLUS GAS DISTRIBUTION	TOTAL
40	2.42	-	2.42
32	1.45	-	1.45
28	2.05	-	2.05
20	1.50	-	1.50
Other (17" or above)	2.10	-	2.10
Total Large Diameter	9.52	1.0	10.52
Small Diameter	-	3.0	3.00
GRAND TOTAL LINE PIPE	9.52	4.0	13.52

* 61,300 kilometers of oil and gas pipeline as previously stated. The above steel requirements are exclusive of that needed for 4,400 kilometers crude line from Irkutsk to Nakhodka on the Pacific Ocean.

Further details of the planned installation of 40-inch pipe are given in the following table:

TABLE 3-59

PLANNED INSTALLATION OF 40-INCH PIPELINE IN THE USSR, 1959-65

ORIGIN	TERMINUS	SERVICE	LENGTH (KILOMETERS)	STEEL PIPE REQUIRED a/ (MILLION METRIC TONS)
Gazli	Chelyabinsk	Natural Gas	1,967	0.590
Gazli	Sverdlovsk	Natural Gas	2,163	0.650
Plus looping of the Chelyabinsk-Sverdlovsk Section			334	0.100
Total Gazli-Ural Gas Pipe Line System			4,464	1.340
Kanevskaya (Krasnodar Kray)	Serpukhov	Natural Gas	1,046	0.310
Ostrogozhsk	Serpukhov	Natural Gas	896	0.270
Shebelinka	Ostrogozhsk	Natural Gas	312 b/	0.090
Kuybyshev	Mozyr'	Crude Oil	1,350 c/	0.410
GRAND TOTAL			8,068	2.420

a/ Calculated at 300 tons per kilometer.
b/ In place.
c/ The major sector of the USSR-European satellite crude oil pipeline.

Total steel requirements for 40-inch pipe during 1959-65 may reach to more than 2.4 million tons. With regard to the 40-inch pipe, Soviet planners originally had estimated the 1959-65 40-inch steel pipe requirement at 3.476 million tons 48/

but evidence suggests that a reduction in wall thickness on the 40-inch pipe, coupled with the probable deletion of at least two 40-inch pipelines from the original plan, has served to reduce this requirement by about one-third. The gas pipelines apparently cancelled included one which was to transport gas from the Stalingrad and Saratov deposits through Penza, Gor'kiy, Vladimir and Ivanovo to Yaroslavl' and a second, also from these deposits, to Chelyabinsk in the Urals. 49/

b. Supply of Steel Pipe

The shortage of steel line pipe, incurred by a failure to complete new pipe mills on schedule, has been of particular concern to Soviet planners. The production of steel pipe from domestic sources reportedly has been sufficient to meet only 75-80 percent of the requirements. 50/ Within this general shortage of steel line pipe, it is apparent that shortages exist in the production of both small diameter (i.e. 20-inches) and large diameter pipe (in particular, 40-inches). That the Soviet Union was lacking not only the 40-inch pipe, but 20-inch as well, was made clear in a newspaper article by A. Kortunov, chief of the Main Administration for the Gas Industry (GlavGaz), which has responsibility for all pipeline construction in the Soviet Union. Kortunov complained that in 1961, because of insufficient domestic output, only 50 percent of the requirements of the gas industry for 20-inch pipe could be met. 51/

Kortunov further stated that the rapid growth in demand for pipe by the oil industry meant reduced deliveries of pipe to the gas industry. He pointed out that in 1960, GlavGaz was allocated for the construction of gas pipeline only 94 percent of that quantity of pipe which had been delivered in 1959, and that in 1961 even less--only 80 percent of the 1959 deliveries.

Yet despite the reduced availability of steel pipe from domestic sources during 1959-61, GlavGaz was able not only to meet gas pipeline construction goals for those years, but exceeded them by about 10 percent. The fact that gas pipeline construction exceeded goals can be attributed directly to the imports of steel pipe, in particular to those quantities of 40-inch pipe purchased from West Germany.

By the end of 1961 the Soviet Union had installed about 1,400 kilometers of 40-inch gas line as follows:

PIPELINE	KILOMETERS
Kanevskaya in Krasnodar Kray to Serpukhov	1,046
Shebelinka in Eastern Ukraine to Ostrogozhsk	312
Initial part of line from Gazli in Uzbekistan to Chelyabinsk in the Urals	150
TOTAL	1,508

Yet only token amounts of 40-inch pipe had been available from Soviet pipe mills. This construction was made possible through importing in 1959-61 of 500,000 tons of 40-inch pipe from West Germany, of which about 450,000 tons were used for the above construction (300 tons per kilometer) and the remaining 50,000 tons went into stockpile.

In addition, during 1960 and 1961 the USSR successfully negotiated for the purchases of 240,000 tons of 40-inch pipe from Italy and 135,000 tons of 40-inch pipe from Sweden. The bulk of deliveries of pipe from both countries is to be carried out during 1962-64. In April of 1962, the West German steel firm of Mannesman A. G. confirmed that it had contracted to supply the USSR with 180,000 tons of large diameter (40-inch) steel pipe for use in gas pipeline construction. Pig iron is to be imported from the USSR for use in manufacture of the pipe and initial deliveries of pig iron already have been made. The contracted deliveries of pipe from Italy, Sweden and West Germany--555,000 tons--will allow the construction of about 1,850 kilometers of pipeline.

Thus, through the imports of 40-inch pipe already in hand and contracted for from West Germany and those contracted for from Italy and Sweden, the USSR has managed to meet almost 40 percent of their Seven Year Plan requirements for 40-inch pipe.

As indicated above, negotiations currently under way between the USSR and Japan involve the proposed purchase by the USSR of about 650,000 tons of 28-inch steel pipe. If a mutually profitable agreement can be reached, it is possible that Japan would construct a pipe mill in Siberia in order to reduce transportation costs. The USSR has indicated that until the pipeline is completed, deliveries of crude oil to Japan could be made over the TransSiberian Railroad, in tank cars which Japan may provide.

It can be said that the imports of 40-inch steel pipe gave new life to the pipeline construction program and averted what could have been a construction plan underfulfillment of far-reaching proportions. The USSR originally had intended to install the first lengths of 40-inch pipe in 1958 in Krasnodar Kray 52/ but the lack of pipe delayed this project for approximately 18 months, and then installation was dependent upon imported pipe. Because the 40-inch pipe has been used to increase deliveries of natural gas to industrial consumers in the Donbas and in the Moscow area, it is probable that certain quantities of residual fuel oil were displaced and that these became available for export.

5. Pipeline Construction Plans, 1961-1980

Grandiose plans have been developed for the construction of oil and gas pipelines in the USSR through 1980. During the 20-year period 1961-80, the USSR hopes to install more than 250,000 kilometers of pipeline, of which 150-170 thousand kilometers would be for the transmission of natural gas and the remainder--80 to 100 thousand kilometers--for the transport of crude oil and petroleum products. 53/ Of the total of 250,000 kilometers, about one-third is to be constructed of 40-inch, 48-inch and 56-inch diameter steel pipe. Steel pipe requirements for gas pipeline construction alone are to reach 30 million tons.

Because of the general design of development of the oil pipeline network, a large portion of new construction during these years will be directed toward the expansion of the carrying capacity of existing systems through the installation of parallel lines. Most of the construction of oil pipeline in new territory will be for the transport of newly discovered crude oil to refineries or export terminals. One major exception is the planned construction of an oil pipeline to the Pacific Coast.* By 1970 the Soviet Union anticipates that all crude oil slated for charge to refining will be handled by pipeline and that by 1980, 80 percent of the product yield will be handled by pipeline.

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* The Irkutsk-Nakhodka line, if steel pipe cannot be obtained from Japan for earlier construction.

The plans for construction of transmission gas pipelines during 1961-80 also reflect the plans for development of extraction of gas in the Ukraine, in Central Asia, in the North Caucasus and in Siberia. By 1980, more than 75 percent of the natural gas produced in the Central Asian republics will be consumed elsewhere. Of this quantity, 57 billion cubic meters will be transported to the European part of the RSFSR and 74 billion cubic meters will be consumed in the Urals and in Siberia. About 40 billion cubic meters of gas from deposits in Kazakhstan will be consumed in the European USSR.

Natural gas from the Ukraine will move to the European part of the RSFSR (33 billion cubic meters), to White Russia, 9 billion cubic meters; Moldavia, 2.5 billion cubic meters; Latvia, 3 billion cubic meters, and Lithuania, 4.5 billion cubic meters.

Gas from Azerbaydzhan will be used to meet the needs of that republic, plus those of Armenia and Georgia. Supplies of gas from the deposits in Krasnodar Kray and Stavropol' Kray, reaching about 40-50 billion cubic meters per year, will move along those routes already established or planned for early construction, i.e. to the Donbas, to coastal areas along the Black Sea and to the central portion of the RSFSR.

In addition to gas from Central Asia, the Urals is to receive 47 billion cubic meters of natural gas from the Berezovo deposit in Siberia and about 11 billion cubic meters per year from the Komi fields in the Soviet North. Also in Siberia, Yakutsk gas will be distributed among consumers in the Soviet Far East.

Because of the wide separation of the gas fields from the major consuming centers, a considerable portion of the pipelines to be built during these years will be quite lengthy, averaging about 3,500 kilometers, and dual and triple-line systems are envisaged. For example, a triple-line gas system is envisaged to carry Central Asian gas to the industrial consumers of the Center. Total pipeline length involved in such a triple-line system would approach 9,000 to 10,000 kilometers.

Another triple-system of comparable length will carry natural gas from new deposits in the Pri-Caspian Depression to consumers in Moscow and Leningrad.

TABLE 3-60

INDICES OF SOVIET GAS PIPELINE DEVELOPMENT a/
1961-70, 1971-80 AND 20-YEAR TOTAL

ITEM	1961-1970	1971-1980	20-YEAR TOTAL
Extraction Of Gas (billion cubic meters per terminal year)	310-325	680-720	-
Length Of New Gas Pipeline (thousand kilometers)	60-70	90-100	150-170
New Compressor Stations	210-220	380	600
Capacity Of Compressor Stations (million kilowatts)	7-7.5	14-15	22.5
Number Of Gas Distribution Stations	1,300	2,600-2,700	3,900-4,000

a/ 54/

Dependent upon the development of gas production in central Yakutia (primarily the Vilyuy fields), Soviet authorities have outlined a vast system of gas pipelines in the Soviet Far East. This system would consist of two major pipelines: one, with a length of 3,370 kilometers, would extend from the gas fields at Taas-Tumuss to Vladivostok; the second, with a length of about 2,000 kilometers, would branch off the first line at the city of Skovorodino and would be built westward to Irkutsk. 55/

Soviet planners have laid out a time-table for the introduction of 48-inch and 56-inch steel pipe in their pipeline system. According to this schedule, as shown in the following tabulation, 48-inch pipe is to be introduced in 1970 and five years later, first use is to be made of 56-inch pipe.

TIME-TABLE ON THE INTRODUCTION OF LARGE DIAMETER PIPE IN THE USSR a/

YEAR	DIAMETER MILLIMETERS	(INCHES)
1946	300	12
1948	500	20
1952	700	28
1956	800	32
1960	1,000	40
1970	1,200	48
1975	1,400	56

a/ 56/

To accompany this time-table, Soviet engineers have developed a comparison of the indices of utilization of the 48-inch and 56-inch steel pipe in the construction of gas pipelines. This comparison, shown below, indicates that the additional capital investment and annual operating expenditures incurred in the installation of larger diameter steel pipe are far outweighed by the higher capacity achieved.

COMPARISON OF THE UTILIZATION OF LARGER DIAMETER PIPE IN THE USSR IN THE CONSTRUCTION OF GAS PIPELINES a/

DIAMETER (mm)	(in.)	ANNUAL CAPACITY (BILLION CUBIC METERS)	WEIGHT OF PIPE (METRIC TONS/ KILOMETERS)	CAPITAL INVESTMENT PER KILOMETER* (THOUSAND RUBLES)	OPERATING EXPENDITURES PER YEAR PER KILOMETER (THOUSAND RUBLES)
700	28	4.5	157.8	56.6	0.43
800	32	6.5	199.8	69.6	0.56
1,000	40	10.0	298.0	100.0	0.83
1,200	48	15.0	358.0	120.0	1.15
1,400	56	25.0	485.0	126.0	1.39

* Excluding compressor stations.
a/ 56/

D. Ability to Transport Exportable Petroleum Surpluses

Any appraisal of future exports of petroleum surpluses from the USSR must, of necessity, begin with the recognition that past surpluses have, in fact, been handled by the existing transportation system. This system has been and remains essentially rail and it is being expanded with plans calling for an increase in petroleum freight handled by railroads from 154 billion ton-kilometers in 1958 to 251 billion ton-kilometers by 1965. Included in such plans are a marked increase in the inventory of tank cars.

The transportation system has been adequate for the USSR to move 800,000 B/D in 1961 to their borders for export and the construction of pipelines to the periphery of the Soviet Bloc will constitute an important supplemental means for petroleum movement. According to the Committee's estimates, the deliverability of the new pipelines currently planned or under construction through 1965 will aggregate approximately 1,500,000 B/D on completion. While these lines, of course, will also be used for delivering petroleum for internal consumption, their capacity provides a measure of future petroleum deliverability to the free world.

It is significant that all of this new pipeline capacity will be built into Baltic, Central Europe and Black Sea destinations. Currently Black Sea ports are the points for export of the great bulk of Soviet petroleum, which reaches these ports by rail and existing pipelines. It should be noted that the new pipeline capacity to terminate at Tuapse and Novorossiysk on the Black Sea will total about 420,000 B/D, thus providing supplemental capacity at Russia's traditional area of export.

It should also be noted that new pipeline capacity to terminate on the Baltic will amount to approximately 720,000 B/D or almost half of the new pipeline capacity being constructed towards Europe and the West. This Baltic capacity constitutes, in essence, a new system for delivering petroleum to the free world providing, in particular, greater access to northern Europe. It is not to be implied that the entire capacity will be used for shipping oil for export, but some of the additional oil for export no doubt will be moving from the Baltic ports of Klaipeda and Ventspils and, perhaps, even Leningrad.

The pipeline capacity to Schwedt in East Germany and Bratislava in Czechoslovakia is estimated at 330,000 B/D. This will add a tremendous amount of transportation potential toward West Europe's border.

In summary, new pipeline capacity planned for completion by 1965 to points of export appears to be as follows:

DESTINATION	CAPACITY 1000 B/D	PERCENT OF TOTAL
Baltic	720	49.0
Central Europe	330	22.4
Black Sea	420	28.6
TOTAL	1,470	100.0

Finally, it should be recognized that the Trans-Siberian line, if extended from Irkutsk to Nakhodka, would provide an additional outlet for petroleum to foreign markets even though it appears that tanker transportation from the Black Sea may be just as economic to this destination which is on the Sea of Japan. The terminal capacity at Nakhodka is estimated at 320,000 B/D if the line has a diameter of 28" and 400,000 B/D if its diameter is 32".

In conclusion the Committee believes that internal transportation will not be a limiting factor to the Bloc ability to deliver petroleum to points of export. Though information is limited on petroleum port capacities, it seems reasonable that these capacities will not pose a limitation. Elsewhere in this report there is an evaluation of the Soviet Tanker fleet which indicates that the Bloc should have no difficulty in meeting tanker requirements to transport potential export volumes to destinations.

APPENDICES

COMMITTEE ESTIMATES OF:

A - INVESTMENT IN SELECTED NEW OIL EXPORT PIPELINES OF THE USSR

B - OPERATING COSTS OF SELECTED NEW OIL EXPORT PIPELINES OF THE USSR

APPENDIX A

COMMITTEE ESTIMATE OF INVESTMENT IN SELECTED NEW OIL EXPORT PIPELINES OF THE USSR

I USSR - EUROPEAN SATELLITE CRUDE OIL PIPELINE SYSTEM INVESTMENT

a. KUYBYSHEV - MICHURINSK

Pipeline, 410 mi. of 40" @ $167,000/mi.	=	$ 68,500,000
Stations, $HP = \frac{862,000 \times 876 \times .000017}{.75} = 17,100$		
17,100 HP x 4 x $300/HP	=	20,500,000
Tank farm, 1,720,000 bbls. @ $1.75	=	3,000,000
Indirect costs & contingency @ 15%	=	13,800,000
		$105,800,000

b. MICHURINSK - MOZYR'

Pipeline, 430 mi. of 40" @ $167,000/mi.	=	$ 71,800,000
Stations, $HP = \frac{840,000 \times 876 \times .000017}{.75} = 16,700$		
16,700 HP x 4 x $300/HP	=	20,000,000
Tank farm, 1,680,000 bbls. @ $1.75	=	2,940,000
Indirect costs & contingency @ 15%	=	14,200,000
		$118,940,000

c. MOZYR' - PLOCK

Pipeline, 470 mi. of 24" @ $75,000	=	$ 35,300,000
Stations, $HP = \frac{238,000 \times 973 \times .000017}{.75} = 5,250$		
5,250 HP x 4 x $300/HP	=	6,300,000
Tank farm, 480,000 bbls. @ $1.75	=	840,000
Indirect costs & contingency @ 15%	=	6,350,000
		$ 48,790,000

d. PLOCK - SCHWEDT

Pipeline, 243 mi. of 20" @ $62,000	=	$ 15,100,000
Stations, $HP = \frac{185,000 \times 1168 \times .000017}{.75} = 4,900$		
4,900 x 3 x $300/HP	=	4,400,000
Tank farm, 370,000 bbls. @ $1.75	=	650,000
Indirect costs & contingency @ 15%	=	3,000,000
		$ 23,150,000

e. MOZYR' - UZHGOROD

Pipeline, 450 mi. of 24" @ $75,000	=	$ 33,800,000
Stations, $HP = \frac{196,000 \times 973 \times .000017}{.75} = 4,300$		
4,300 x 4 x $300/HP	=	5,200,000
Tank farm, 400,000 bbls. @ $1,75	=	700,000
Indirect cost & contingency @ 15%	=	6,000,000
		$ 45,700,000

f. UZHGOROD - BRATISLAVA

Pipeline, 250 mi. of 21" @ $67,000	=	$ 16,800,000
Stations, $HP = \frac{196,000 \times 1115 \times .000017}{.75} = 5,000$		
5,000 x 3 x $300/HP	=	4,500,000
Indirect costs & contingency @ 15%	=	3,200,000
		$ 24,500,000

g. SAHY - SZAZHALOMBATTA

Pipeline, 81 mi. of 12" @ $40,000	=	$ 3,240,000
Stations, $HP = \frac{55,000 \times 1192 \times .000017}{.75} = 1,500$		
1,500 x 1 x $300/HP	=	450,000
Indirect costs & contingency @ 15%		550,000
		$ 4,240,000

h. MICHURINSK - KREMENCHUG

Pipeline, 435 mi. of 20" @ $62,000	=	$ 27,000,000
Stations, $HP = \frac{167,000 \times 1168 \times .000017}{.75} = 4,420$		
4,420 HP x 4 x $300/HP	=	5,300,000
Indirect costs & contingency @ 15%	=	4,850,000
		$ 37,150,000

i. UNECHA - POLOTSK

Pipeline, 234 mi. of 28" @ $95,000	=	$ 22,200,000
Stations, $HP = \frac{392,000 \times 1252 \times .000017}{.75} = 11,150$		
11,150 x 2 x $300/HP	=	6,700,000
Tank farm, 700,000 bbls. @ $1.75	=	1,200,000
Indirect costs & contingency @ 15%	=	4,500,000
		$ 34,600,000

j. POLOTSK - KLAIPEDA

Pipeline, 296 mi. of 24" @ $75,000	=	$ 22,200,000
Stations, $HP = \frac{260,000 \times 973 \times .000017}{.75} = 5,730$		
5,730 HP x 3 x $300/HP	=	5,200,000
Tank farm, 1,300,000 bbls. @ $1.75	=	2,300,000
Indirect costs & contingency @ 15%	=	5,200,000
		$ 34,900,000

k. POLOTSK - VENTSPILS

Pipeline, 296 mi. of 20" @ $62,000	=	$ 18,400,000
Stations, $HP = \frac{210,000 \times 1168 \times .000017}{.75} = 5,550$		
5,550 x 3 x $300/HP	=	5,000,000
Tank farm, 900,000 bbls. @ $1.75	=	1,570,000
Indirect costs & contingency @ 15%	=	3,740,000
		$ 28,710,000

APPENDIX A (CONT'D.)

COMMITTEE ESTIMATE OF INVESTMENT IN SELECTED NEW OIL EXPORT PIPELINES OF THE USSR

II ANGARSK (IRKUTSK) - NAKHODKA CRUDE OIL PIPELINE

a. ASSUMED 28-inch DIAMETER

Pipeline, 2,740 mi. of 28" @ $95,000	=	$260,300,000
Stations, HP = $\frac{370,000 \times 1252 \times .000017}{.75} = 10,450$		
10,450 x 21 x $300/HP	=	65,835,000
Tank farm, 750,000 bbls. @ $1.75	=	1,310,000
Indirect costs & contingency @ 15%	=	49,000,000
		$376,445,000

b. ASSUMED 32-INCH DIAMETER

Pipeline, 2,740 mi. of 32" @ $122,000	=	$334,280,000
STATIONS, HP = $\frac{465,000 \times 1100 \times .000017}{.75} = 11,600$		
11,600 x 19 x $300/HP	=	66,120,000
Tank farm, 900,000 bbls. @ $1.75	=	1,575,000
Indirect costs & contingency @ 15%	=	60,500,000
		$462,475,000

III AL'MET'YEVSK - LENINGRAD CRUDE OIL PIPELINE INVESTMENT

a. AL'MET'YEVSK - GOR'KIY

Pipeline, 350 mi. of 32" @ $122,000	=	$ 42,700,000
Stations, HP = $\frac{400,000 \times 1100 \times .000017}{.75} = 10,000$		
10,000 x 2 x $300/HP	=	6,000,000
Tank farm, 800,000 bbls. @ $1,75	=	1,400,000
Indirect costs & contingency @ 15%	=	7,500,000
		$ 57,600,000

b. GOR'KIY - LENINGRAD

Pipeline, 585 mi. of 28" @ $95,000	=	$ 55,575,000
Stations, HP = $\frac{360,000 \times 1252 \times .000017}{.75} = 10,200$		
10,200 Hp x 4 x $300/HP	=	12,240,000
Tank farm, 1,600,000 bbls. @ $1.75	=	2,800,000
Indirect costs & contingency @ 15%	=	10,600,000
		$ 81,215,000

IV STALINGRAD - TIKHORETSK - TUAPSE AND TIKHORETSK - NOVOROSSIYSK CRUDE OIL PIPELINE INVESTMENT

a. STALINGRAD - TIKHORETSK

Pipeline, 380 mi. of 28" @ $95,000	=	$ 36,100,000
Stations, HP = $\frac{378,000 \times 1252 \times .000017}{.75} = 10,720$		
10,720 x 3 x $300/HP	=	9,660,000
Tank farm, 650,000 bbls. @ $1.75	=	1,138,000
Indirect costs & contingency @ 15%	=	7,050,000
		$ 53,948,000

b. TIKHORETSK - TUAPSE OR NOVOROSSIYSK

Pipeline, 140 mi. of 28" @ $95,000	=	$ 13,300,000
Stations, HP = $\frac{245,000 \times 1252 \times .000017}{.75} = 6,960$		
6,960 HP x 1 x $300/HP	=	2,100,000
Tank farm, 1,200,000 bbls. @ $1.75	=	2,100,000
Indirect costs & contingency @ 15%	=	2,620,000
		$ 20,120,000

V TUYMAZY - ANGARSK (IRKUTSK) CRUDE OIL PIPELINE INVESTMENT

Pipeline, 2300 mi. of 28" @ $95,000	=	$218,500,000
Stations, HP = $\frac{370,000 \times 1252 \times .000017}{.75} = 10,450$		
10,450 x 18 x $300/HP	=	56,500,000
Tank farm, 750,000 bbls. @ $1.75	=	1,310,000
Indirect costs and contingency @ 15%	=	41,500,000
		$317,810,000

APPENDIX B

COMMITTEE ESTIMATE OF OPERATING COSTS OF SELECTED NEW OIL EXPORT PIPELINES OF THE USSR

SUMMARY OF OPERATING COSTS

PIPELINE	CENTS PER BARREL
USSR - European Satellite	
Kuybyshev to Mozyr'	17.10
Kuybyshev to Plock	29.30
Kuybyshev to Schwedt	37.60
Kuybyshev to Kremenchug	21.85
Kuybyshev to Bratislava	38.20
Kuybyshev to Szazhalombatta	39.70
Kuybyshev to Polotsk	20.65
Kuybyshev to Klaipeda	29.20
Kuybyshev to Ventspils	29.55
Tuymazy to Angarsk (Irkutsk)	54.00
Angarsk to Nakhodka	64.00
Tuymazy to Nakhodka	118.00
Al'met'yevsk to Gor'kiy	8.01
Al'met'yevsk to Leningrad	21.26
Stalingrad to Tikhoretsk	9.24
Stalingrad to Tuapse or Novorossiysk	12.88

APPENDIX B (Cont'd.)

COMMITTEE ESTIMATE OF
OPERATING COSTS OF SELECTED NEW OIL EXPORT PIPELINES
OF THE USSR

I OPERATING COSTS FOR USSR - EUROPEAN SATELLITE CRUDE OIL PIPELINE SYSTEM

a. KUYBYSHEV - MICHURINSK

Direct Expense	
1. Line maintenance @ $100/mi.	$ 41,000
2. Station maintenance @ $5/HP	342,000
3. Power @ $.02/KW-HR	7,500,000
4. Labor @ $3,500/Man	105,000
5. Administration	50,000
	$ 8,038,000
Indirect Expense	
1. Average interest @ 3%	$ 3,170,000
2. Depreciation @ 10%	10,580,000
	$ 13,750,000

Cost per Barrel = $\frac{\$\ 21,788,000}{740,000 \times 365}$ = 8.05¢

b. MICHURINSK - MOZYR'

Direct Expense	
1. Line maintenance @ $100/mi.	$ 43,000
2. Station maintenance @ $5/HP	334,000
3. Power @ $.02/KW-HR	7,420,000
4. Labor @ $3,500/Man (30 Men)	105,000
5. Administration	50,000
	$ 7,952,000
Indirect Expense	
1. Average interest @ 3%	$ 3,570,000
2. Depreciation @ 10%	11,894,000
	$ 15,464,000

Cost per Barrel = $\frac{\$\ 23,416,000}{710,000 \times 365}$ = 9.05¢

bl. MICHURINSK-UNECHA

Prorated on mileage from b. above.

Cost per Barrel = 6.90¢

c. MOZYR' - PLOCK

Direct Expense	
1. Line maintenance @ $100/mi.	$ 47,000
2. Station maintenance @ $5/HP	105,000
3. Power @ $.02/KW-HR	2,330,000
4. Labor @ $3,500/Man (22 Men)	77,000
5. Administration	30,000
	$ 2,589,000
Indirect Expense	
1. Average interest	$ 1,465,000
2. Depreciation	4,879,000
	$ 6,344,000

Cost per Barrel = $\frac{\$\ 8,933,000}{200,000 \times 365}$ = 12.2¢

d. PLOCK - SCHWEDT

Direct Expense	
1. Line Maintenance @ $100/mi.	$ 24,300
2. Station Maintenance @ $5/HP	73,500
3. Power @ $.02/KW-HR	1,630,000
4. Labor @ $3,500/Man (18 Men)	63,000
5. Administration	30,000
	$ 1,820,800
Indirect Expense	
1. Average interest	$ 695,000
2. Depreciation	2,315,000
	$ 3,010,000

Cost per Barrel = $\frac{\$\ 4,830,800}{160,000 \times 365}$ = 8.3¢

e. MOZYR' - UZHGOROD

Direct Expense	
1. Line maintenance @ $100/mi.	$ 45,000
2. Station maintenance @ $5/HP	86,000
3. Power @ $.02/KW-HR	1,910,000
4. Labor @ $3,500/Man (22 Men)	77,000
5. Administration	30,000
	$ 2,148,000
Indirect Expense	
1. Average interest	$ 1,370,000
2. Depreciation	4,570,000
	$ 5,940,000

Cost per Barrel = $\frac{\$\ 8,088,000}{170,000 \times 365}$ = 13.0¢

f. UZHGOROD - BRATISLAVA

Direct Expense	
1. Line maintenance @ $100/mi.	$ 25,000
2. Station maintenance @ $5/HP	75,000
3. Power @ $.02/KW-HR	1,670,000
4. Labor @ $3,500/Man (18 Men)	63,000
5. Administration	30,000
	$ 1,863,000
Indirect Expense	
1. Average interest	$ 735,000
2. Depreciation	2,450,000
	$ 3,185,000

Cost per Barrel = $\frac{\$\ 5,048,000}{170,000 \times 365}$ = 8.1¢

g. SAHY - SZAZHALOMBATTA

Direct Expense	
1. Line maintenance @ $100/mi.	$ 8,100
2. Station maintenance @ $5/HP	7,500
3. Power @ $.02/KW-HR	166,000
4. Labor @ $3,500/Man (7 Men)	25,000
5. Administration	10,000
	$ 216,600
Indirect Expense	
1. Average interest	$ 127,000
2. Depreciation	424,000
	$ 551,000

Cost per Barrel = $\frac{\$\ 767,600}{50,000 \times 365}$ = 4.2¢

h. MICHURINSK - KREMENCHUG

Direct Expense	
1. Line maintenance @ $100/mi.	$ 43,500
2. Station maintenance @ $5/HP	89,000
3. Power @ $.02/KW-HR	1,960,000
4. Labor @ $3,500/Man (22 Men)	77,000
5. Administration	30,000
	$ 2,199,500
Indirect Expense	
1. Average interest	$ 1,110,000
2. Depreciation	3,715,000
	$ 4,825,000

Cost per Barrel = $\frac{\$\ 7,024,500}{140,000 \times 365}$ = 13.8¢

APPENDIX B (Cont'd.)

COMMITTEE ESTIMATE OF
OPERATING COSTS OF SELECTED NEW OIL EXPORT PIPELINES
OF THE USSR

I OPERATING COSTS FOR USSR - EUROPEAN SATELLITE CRUDE OIL PIPELINE SYSTEM. . .(Cont'd.)

i. UNECHA - POLOTSK

Direct Expense	
1. Line maintenance @ $100/mi.	$ 23,400
2. Station maintenance @ $5/HP	111,500
3. Power @ $.02/KW-HR	2,480,000
4. Labor @ $3,500/Man (18 Men)	63,000
5. Administration	30,000
	$ 2,707,900
Indirect Expense	
1. Average interest	$ 1,040,000
2. Depreciation	3,460,000
	$ 4,500,000

Cost per Barrel = $\frac{\$\ 7,207,900}{340,000 \times 365}$ = 5.8¢

j. POLOTSK - KLAIPEDA

Direct Expense	
1. Line maintenance @ $100/mi.	$ 29,600
2. Station maintenance @ $5/HP	86,000
3. Power @ $.02/KW-HR	1,910,000
4. Labor @ $3,500/Man (18 Men)	63,000
5. Administration	30,000
	$ 2,118,600
Indirect Expense	
1. Average interest	$ 1,075,000
2. Depreciation	3,590,000
	$ 4,665,000

Cost per Barrel = $\frac{\$\ 6,783,600}{220,000 \times 365}$ = 8.45¢

k. POLOTSK - VENTSPILS

Direct Expense	
1. Line maintenance @ $100/mi.	$ 29,600
2. Station maintenance @ $5/HP	84,000
3. Power @ $.02/KW-HR	1,850,000
4. Labor @ $3,500/Man (18 Men)	63,000
5. Administration	30,000
	$ 2,056,600
Indirect Expense	
1. Average interest	$ 860,000
2. Depreciation	2,871,000
	$ 3,731,000

Cost per Barrel = $\frac{\$\ 5,787,600}{180,000 \times 365}$ = 8.80¢

II OPERATING COSTS OF ANGARSK (IRKUTSK) - NAKHODKA CRUDE OIL PIPELINE

a. ASSUMED 28-INCH DIAMETER

Direct Expense	
1. Line maintenance @ $100/mi.	$ 274,000
2. Station maintenance @ $5/HP	1,100,000
3. Power @ $.02/KW-HR	24,300,000
4. Labor @ $3,500/Man (147 Men)	515,000
5. Administration	250,000
	$ 26,439,000
Indirect Expense	
1. Average interest @ 3%	$ 11,300,000
2. Depreciation @ 10%	37,645,000
	$ 48,945,000

Cost per Barrel = $\frac{\$\ 75,384,000}{320,000 \times 365}$ = 64.0¢

b. ASSUMED 32-INCH DIAMETER

Direct Expense	
1. Line maintenance @ $100/mi.	$ 274,000
2. Station maintenance @ $5/HP	1,100,000
3. Power @ $.02/KW-HR	24,450,000
4. Labor @ $3,500/Man (133 Men)	465,000
5. Administration	250,000
	$ 26,539,000
Indirect Expense	
1. Average interest	$ 13,900,000
2. Depreciation	46,247,500
	$ 60,147,500

Cost per Barrel = $\frac{\$\ 86,686,500}{400,000 \times 365}$ = 59.3¢

III OPERATING COSTS OF THE AL'MET'YEVSK - LENINGRAD CRUDE OIL PIPELINE

a. AL'MET'YEVSK - GOR'KIY

Direct Expense	
1. Line maintenance @ $100/mi.	$ 35,000
2. Station maintenance @ $5/HP	100,000
3. Power @ $.02/KW-HR	2,220,000
4. Labor @ $3,500/Man (18 Men)	63,000
5. Administration	30,000
	$ 2,448,000
Indirect Expense	
1. Average interest	$ 1,730,000
2. Depreciation	5,760,000
	$ 7,490,000

Cost per Barrel = $\frac{\$\ 9,938,000}{340,000 \times 365}$ = 8.01¢

b. GOR'KIY - LENINGRAD

Direct Expense	
1. Line maintenance @ $100/mi.	$ 58,500
2. Station maintenance @ $5/HP	204,000
3. Power @ $.02/KW-HR	4,530,000
4. Labor @ $3,500/Man (28 Men)	98,000
5. Administration	50,000
	$ 4,940,500
Indirect Expense	
1. Average interest	$ 2,430,000
2. Depreciation	8,121,500
	$ 10,551,500

Cost per Barrel = $\frac{\$\ 15,492,000}{320,000 \times 365}$ = 13.25¢

APPENDIX B (Cont'd.)

COMMITTEE ESTIMATE OF
OPERATING COSTS OF SELECTED NEW OIL EXPORT PIPELINES
OF THE USSR

IV OPERATING COSTS OF THE STALINGRAD - TIKHORETSK - TUAPSE AND TIKHORETSK - NOVOROSSIYSK CRUDE OIL PIPELINE

a. STALINGRAD - TIKHORETSK

Direct Expense	
1. Line maintenance @ $100/mi.	$ 38,000
2. Station maintenance @ $5/HP	161,000
3. Power @ $.02/KW-HR	3,560,000
4. Labor @ $3,500/Man (28 men)	98,000
5. Administration	50,000
	$ 3,907,000
Indirect Expense	
1. Average interest	$ 1,620,000
2. Depreciation	5,395,000
	$ 7,015,000

Cost per Barrel = $\frac{\$\ 10,922,000}{324,000 \times 365}$ = 9.24¢

b. TIKHORETSK - TUAPSE OR NOVOROSSIYSK

Direct Expense	
1. Line maintenance @ $100/mi.	$ 14,000
2. Station maintenance @ $5/HP	35,000
3. Power @ $.02/KW-HR	77,300
4. Labor @ $3,500/Man (10 Men)	35,000
5. Administration	15,000
	$ 176,300
Indirect Expense	
1. Average interest	$ 603,600
2. Depreciation	2,012,000
	$ 2,615,600

Cost per Barrel = $\frac{\$\ 2,791,900}{210,000 \times 365}$ = 3.64¢

V OPERATING COSTS OF THE TUYMAZY TO ANGARSK (IRKUTSK) CRUDE OIL PIPELINE

Direct Expense	
1. Line maintenance @ $100/mi.	$ 230,000
2. Station maintenance @ $5/HP	930,000
3. Power @ $.02/KW-HR	20,400,000
4. Labor @ $3,500/Man (126 Men)	440,000
5. Administration	250,000
	$ 22,250,000
Indirect Expense	
1. Average interest @ 3%	$ 9,500,000
2. Depreciation @ 10%	31,780,000
	$ 41,280,000

Cost per Barrel = $\frac{\$\ 63,530,000}{320,000 \times 365}$ = 54.0¢

SECTION 12

ESTIMATED INVESTMENT IN PETROLEUM INDUSTRY

The estimated distribution of the planned productive capital investment in the oil and gas industry during 1959-65 compared with those sums invested during 1952-58, is presented in Table 3-61.

The Soviet Seven Year Plan provides for a total investment in the oil and gas industry of 17.0-17.3 billion rubles during the period 1959-65. 1/ Of this amount 75.9 percent is to be invested in the oil industry and 24.1 percent in the gas industry. 2/ Applying these percentages to the mid-point of the planned total investment yields an estimated investment of 13.02 billion rubles in the oil industry, and 4.13 billion rubles in the gas industry. Of the total investment of 17.15 billion rubles in the oil and gas industries, 42 percent, or 7.2 billion rubles are to be used for exploratory and developmental drilling and extraction and 33.9 percent, or 5.82 billion rubles, are to be used in the oil industry for other purposes. 3/ Of this latter amount approximately 2.0 billion rubles are to be used for pipeline transport. 4/ This leaves a residual of 3.82 billion rubles for investment in refining and storage facilities. The portion allocated to storage probably is small, perhaps 0.15-0.2 billion rubles. On this basis the estimate of about 3.6 billion rubles to be invested in refining facilities (see page 158) appears reasonable.

TABLE 3-61

ESTIMATED PRODUCTIVE INVESTMENT IN THE OIL
AND NATURAL GAS INDUSTRIES OF THE USSR,
BY SECTOR OF INDUSTRY
1952-58 AND 1959-65
(In Comparable Prices)

	1952-58		1959-65	
	BILLION RUBLES	PERCENT OF TOTAL	BILLION RUBLES	PERCENT OF TOTAL
OIL				
Oil Extraction				
Exploratory and Development Drilling	2.57	35.6	4.30	25.1
Extraction	1.75	24.2	2.90	16.9
TOTAL	4.32	59.8	7.20	42.0
Refining (including petrochemical installations at refineries) and Storage	(	(	3.80	22.6
	(1.95	(27.0		
Pipeline Construction	(	(	2.00	11.7
Total Oil	6.27	86.8	13.02	75.9
NATURAL GAS				
Gas Extraction				
Exploratory and Development Drilling	.33	4.6	1.30	7.6
Extraction	.25	3.5	.69	4.0
TOTAL	.58	8.0	1.99	11.6
Pipeline Construction	.37	5.2	1.77	10.3
Other (primary storage)	.0	.0	.37	2.2
Total Gas	.95	13.2	4.13	24.1
GRAND TOTAL, OIL AND NATURAL GAS	7.22	100.0	17.15*	100.0

* Mid-point of the range of 170-173 billion rubles as stated in the Seven Year Plan.

SECTION 13

CONSUMPTION

A. Petroleum Products

1. Historical and Planned

The apparent domestic demand for non-gaseous petroleum products in the USSR in 1955, 1958-1960 and that estimated for 1965 is given in Table 3-62. In relation to crude oil production, this demand has declined from 87 percent in 1955 to 72.6 percent in 1960. A further decline is indicated for the remaining years of the Seven Year Plan, to about 68 percent of crude oil production by 1965 (see Tables 3-18 and 3-62).

The very nature of the Soviet economy makes it impossible to rationalize the growth lag for petroleum products compared with the increases in crude oil output simply by stating that the production of crude oil has increased more rapidly than the domestic needs. The possibility must be considered that the growing exports of petroleum products may exist only at the expense of the internal economy. This may be true, in particular, for diesel fuel, which is a leading Soviet export item, having represented slightly more than one-third of total Soviet exports of petroleum products in 1960, but which has been reported to have been in short supply in the Soviet Union at least since the beginning of the Seven Year Plan. To find precedents for such maneuvers, one need only recall the early days of the planned development of the Soviet economy, when grain, although in desperate need at home, was bartered for equipment necessary for the establishment of a heavy industry sector.

In Table 3-63, estimated domestic consumption for 1955, 1958 and 1960 has been broken down according to the type of petroleum product. The breakdown illustrates the growing importance of distillates and the decline in the relative consumption of gasoline. It is known that the availability of gasoline in the USSR has for the past several years continued to exceed the domestic requirements but the poor quality of this product effectively precludes any sizeable export to the West. In fact, the net export of gasoline in 1960 was only 600 thousand tons. As a result, the USSR has resorted to various means for disposal of the surplus internally, e.g. in light diesel fuel blends.

TABLE 3-62

APPARENT DOMESTIC DEMAND FOR NON-GASEOUS PETROLEUM PRODUCTS IN THE USSR 1955, 1958-60 AND 1965 ESTIMATE (Million Metric Tons)

SUPPLY	1955	1958	1959	1960	ESTIMATE 1965
Refinery Products a/	62.9	95.7	106.7	119.6	197.0
Imports b/	3.8	3.2	3.3	3.2	3.0
NGL and Synthetics c/	negl.	negl.	negl.	negl.	5.0
TOTAL SUPPLY	66.7	98.9	110.0	122.8	205.0
DEMAND					
Apparent Domestic Demand d/	61.6	89.9	97.1	107.4	180.0
Exports b/	5.1	9.0	12.9	15.4	25.0
TOTAL DEMAND	66.7	98.9	110.0	122.8	205.0

a/ Derived from Table 3-42.
b/ 1/
c/ Estimate.
d/ By difference.

TABLE 3-63

ESTIMATED DOMESTIC CONSUMPTION OF NON-GASEOUS PETROLEUM PRODUCTS IN THE USSR BY TYPE OF PRODUCT a/

1955, 1958 AND 1960

TYPE OF PRODUCT	1955 MILLION METRIC TONS	1955 PERCENT OF TOTAL	1958 MILLION METRIC TONS	1958 PERCENT OF TOTAL	1960 MILLION METRIC TONS	1960 PERCENT OF TOTAL
Gasoline	18.6	30.2	22.7	25.3	25.4	23.7
Kerosine	9.6	15.6	12.0	13.4	14.5	13.5
Diesel Fuel	9.6	15.6	21.6	24.0	24.2	22.5
Lubricants	2.6	4.2	4.4	4.9	5.2	4.8
Residuals and Others c/	21.2	34.4	29.1	32.4	38.1	35.5
TOTAL b/	61.6	100.0	89.8	100.0	107.4	100.0

a/ Refinery output plus imports minus exports.
b/ Totals may not always equal the sum of the components because of rounding.
c/ Primarily residual fuel oil.

As mentioned above, diesel fuel is considered to be in short supply in the USSR. This deficiency probably results from a combination of continued high rates of growth in demand for diesel fuel through the dieselization of tractors and rail transport and "forced" inclusion of diesel fuel as an item for export, despite excess requirements for this product internally.

The major and growing portion of diesel fuel is consumed by agriculture, while consumption of diesel fuel by industry and construction exterprises is in a relative decline, as illustrated by the following (consumption of diesel fuel as a percent of the total): 2/

CONSUMER	1960	1962 PLAN
Agriculture	42.2	48.2
Transport	23.0	25.4
Industry, Construction and Other	34.8	26.4
TOTAL	100.0	100.0

Advantage has been taken of the high yield of the category "residuals and others" in that increasing amounts of residual fuel oil are becoming available as a result of displacement by natural gas, and this exportable surplus is finding receptive markets in Northern Europe and Scandinavia. Nevertheless, residual fuel oil has been, and remains, the petroleum product most in demand by the domestic economy.

The major component of the residual fuel oil category in the USSR is the so-called furnace mazut, the consumption of which in 1965, excluding usage as a raw material, is to reach 62 million tons. Of this total, 10 million tons is to be consumed by rail, river and ocean-going transport. Virtually all of the remainder will be consumed by various industrial enterprises, almost one-half to be consumed by thermal electric power stations in the generation of electricity and heat.

Allocation of the domestic consumption of petroleum products according to consuming sector for the years 1959 and 1965 is given in Table 3-64. As shown, only minor shifts with respect to the relative share of total consumption are evident for each of the consuming sectors. Of interest is the stability of the share of total consumption accounted for by the communal-everyday economy, which is estimated to represent 2.6 percent of the total in 1959 and 2.3 percent in 1965. An examination of total fuel requirements by the urban-rural economy of the Soviet Union in 1958 and that planned for 1965, based on the data presented in Table 3-65, indicates that in opposition to the fuel-producing economy as a whole, the share of coal in the fuel balance for the urban-rural economy is to increase. Allocations of petroleum products--kerosine and heating oil--to urban-rural household consumers are less, for example, than peat. In 1958, per capita consumption of kerosine and fuel oil in the urban-rural economy averaged less than 11 kilograms and is to increase to only slightly more than 18 kilograms by 1965. This sector, particularly in the rural areas, is to a large degree dependent upon locally-gathered fuels such as wood, chips and the like for heating and cooking. In fact, Soviet authorities so far have made little effort to increase deliveries of fuel to the rural areas and, as a result, those people have been left largely to their own devices.

2. Prospects for the Future

Application of consumption growth rates presented in a long range study of the probable demand for petroleum products in the USSR by 1972/75, developed by Gosplan and published in late 1959, yields a rough approximation of demand for this period. According to this study, 6/ consumption of petroleum products in 1972/75 was to be 1.91 times consumption in 1965 and 3.98 times consumption in 1958. Thus, using these growth rates, it may be estimated that consumption in 1972/75 may approach 340 to 360 million tons. Further, the study presented a probable distribution of consumption of petroleum products in 1975, according to consuming sector:

TABLE 3-64

ESTIMATED CONSUMPTION OF NON-GASEOUS PETROLEUM PRODUCTS IN THE USSR, BY CONSUMER 1959 AND 1965

CONSUMER	1959 MILLION METRIC TONS	1959 PERCENT OF TOTAL a/	1965 MILLION METRIC TONS	1965 PERCENT OF TOTAL a/
Industry	43.7	45.0	82.8	46.0
Agriculture	19.4	20.0	34.2	19.0
Transport	15.5	16.0	32.4	18.0
Communal-Everyday	2.5 b/	2.6	4.2 c/	2.3
Military and Other d/	16.0 e/	16.4	26.4 e/	14.7
TOTAL	97.1 f/	100.0	180.0 f/	100.0

a/ Except where noted, after 3/.
b/ Estimate based on 4/.
c/ Derived from Table 3-65.
d/ Includes consumption by the Civil Air Fleet.
e/ Residual.
f/ Derived from Table 3-62.

TABLE 3-65

CONSUMPTION OF PETROLEUM PRODUCTS AND OTHER FUELS
BY THE URBAN-RURAL ECONOMY OF THE USSR a/
1958 AND 1965 PLAN

TYPE OF FUEL	UNIT OF MEASURE	1958			1965 PLAN		
			STANDARD FUEL			STANDARD FUEL	
		NATURAL UNITS	THOUSAND METRIC TONS	PERCENT OF TOTAL	NATURAL UNITS	THOUSAND METRIC TONS	PERCENT OF TOTAL
Coal	Thousand Metric Tons	60,070	52,472	49.0	102,000	84,390	54.0
Peat	Thousand Metric Tons	11,918	5,010	4.7	18,890	7,930	5.1
Gas b/	Million Cubic Meters	3,517	4,095	3.8	14,389	17,650	11.3
Mazut b/	Thousand Metric Tons	326	468	0.4	845	1,215	0.8
Kerosine	Thousand Metric Tons	1,950	2,800	2.6	3,335	4,700	3.0
Wood and Other		-	42,155	39.5		40,515	25.8
TOTAL			107,000	100.0		156,400	100.0

a/ 5/ Excludes electric power and heat from power stations, equivalent to 7 million tons of standard fuel in 1958 and a planned 15 million tons of standard fuel in 1965.

b/ Consumption limited to the urban economy.

CONSUMING SECTOR	PERCENT OF TOTAL
Industry	47.4
Agriculture	16.2
Transport	22.2
Military, Communal-Everyday and Other	14.2
TOTAL	100.0

Comparison of this distribution by consuming sector with those estimated for 1959 and 1965, as shown in Table 3-64, above, shows little change was anticipated in the relative shares.

If nothing more, this study points out the strong probability that continued, and growing, exportable surpluses of petroleum may be available at least through 1975, as elsewhere in this report it has been noted that current Soviet plans call for the production of crude oil to reach to 390 million tons in 1970 and to 545 million tons in 1975. When related to the rough approximations of domestic demand for 1972/75, these production plans may be interpreted as capable of supporting a petroleum export program of mounting importance.

B. Natural Gas

The structure of the consumption pattern of natural gas for the years 1957-1960, together with the plan for 1965 and 1980, is shown on Table 3-66.

The most striking aspect of the distribution of consumption of natural gas in the USSR among the various consumers is the very minor portion of annual natural gas availability which is allocated to the so-called communal-everyday sector. This sector, which includes the consumption of gas by households for cooking and heating of water, the providing of central heat to apartments and similar buildings, and the consumption by communal enterprises such as laundries, restaurants, meeting halls and the like, accounted for about one-eighth (12.6 percent) of total natural gas consumed in 1960. It is estimated that the share of the communal-everyday sector will be only 9.37 percent in 1965 and 10.0 percent in 1980.

At the end of 1958, more than 1.7 million apartments in the USSR were equipped to use natural gas. (See Table 3-67) In turn these apartments provided living quarters for 15.5

TABLE 3-66

STRUCTURE OF CONSUMPTION OF NATURAL GAS
IN THE USSR 1957-60, 1965 AND 1980 PLANS
(Percent of Total)

CONSUMER	1957 a/	1958 a/	1959 a/	1960 a/	1965 b/ PLAN	1980 d/ PLAN
Communal-Everyday	11.9	10.5	12.4	12.6	9.37	10.0
Transport	0.3	0.5	0.3	0.5)		
				)	1.00	-
Agriculture	0.1	0.1	0.1	0.1)		
Consumption in Gas Transmission and Losses	3.6	3.2	2.2	3.5	7.70 c/	6.2
Industry:						
Chemical	0.8	1.0	2.7	4.2	5.60	2.5
Heavy Metallurgy	1.2	6.1	7.7	11.2	17.80	11.7
Cement	5.5	5.4	5.8	6.5	5.60	5.8
Machine Construction and Metal-Working	3.9	6.5	7.9	7.5	8.00	2.8
Oil and Gas	28.7	20.2	16.7	13.2	4.10	2.9
Industry of Construction Materials and Construction	1.4	3.1	4.0	3.5	0.10	0.8
Light	-	0.7	1.7	1.3)		
Food	2.4	2.1	2.9	2.7)	19.33	
Other	7.4	6.1	6.0	6.1)		10.1
Electric Power Stations	32.8	34.5	29.6	27.1	21.40	40.3
Industrial Energetics	*	*	*	*	*	6.9
TOTAL INDUSTRY	84.1	85.7	85.0	83.3	81.93	83.8
GRAND TOTAL	100.0	100.0	100.0	100.0	100.00	100.0

a/ 7/
b/ 8/
c/ 9/
d/ 10/
* Not broken out in above totals.

million people (averaging about 9 persons per apartment) or 17.5 percent of the urban population of the country. 15/ By the close of the Seven Year Plan in 1965, Soviet planners hope that natural gas will be available to more than 42 million people.

To distribute those quantities of natural gas allocated to the communal-everyday sector, a system of city distribution lines is slowly developing, as shown in Table 3-68. A total of 25,000 kilometers of such lines is planned for installation during 1959-65. 18/ The failure to equip this sector at a more rapid rate with gas consuming facilities such as stoves and hot water heaters has been one of the major factors in the shortfalls in annual gas production goals during the past several years. With only 10 percent of the national total (72 billion cubic meters) allocated to the communal-everyday sector in 1980 the Soviet authorities claim that more than 60 percent of the population will be served by natural gas through a central supply system.

This is in sharp contrast to the U.S. patterns for consumption of gas. In 1960 the U.S. consumed about 347 billion cubic meters of gas, of which 25 percent or 87 billion cubic meters went to meet residential needs. Table 3-69 illustrates natural gas end use in the U.S. in 1960.

The American Gas Association estimates that as of the end of 1960 there were 30.83 million residential household consumers of gas, broken down as follows: 22/

	MILLION HOUSEHOLDS*
Central Gas Heating	12.94
Non-central Heating	8.41
Other	9.48
TOTAL	30.83

* These statistics include mixed and manufactured gas as well as natural gas customers, but the share of the former for residential and commercial space heating in 1960 was only 4 percent of the total supplied.

Assuming an average of 3.4 persons for each household, then in 1960 about 104 million people in the U.S. were supplied with

TABLE 3-67

NUMBER OF APARTMENTS EQUIPPED FOR THE USE OF NATURAL GAS IN THE USSR SELECTED YEARS 1950-1960 (THOUSANDS)

YEAR	APARTMENTS SUPPLIED BY GAS MAINS	APARTMENTS SUPPLIED BY LPG	TOTAL
1950 a/	605	8	613
1955 a/	1,140	86	1,226
1957 a/	1,448	157	1,605
1958	1,470	230 b/	1,700 c/
1959 a/	2,089	449	2,538
1960 d/	2,567	757	3,324

a/ 11/
b/ 12/
c/ 13/
d/ 14/

TABLE 3-68

CITY GAS DISTRIBUTION SYSTEM OF THE USSR a/ SELECTED YEARS 1945-61

YEAR	KILOMETERS
1945 (1 October)	2,371
1953 (1 October)	5,440
1956 (1 January)	7,055
1958 (1 January)	8,594
1960 (1 January)	11,728
1961 (1 January)	14,617 b/

a/ Except where noted, from 16/.
b/ 17/

87 billion cubic meters of gas, or an annual consumption of 830 cubic meters of gas per person being served.

TABLE 3-69

NATURAL GAS END USE IN THE U.S. - 1960

CONSUMER	AMOUNT (BILLION CUBIC METERS)	PERCENT OF TOTAL
Residential	87	25.0
Commercial	29	8.0
TOTAL	116 a/	33.0
Electric Utilities	49 b/	14.0
Industrial		
General	100 c/	29.0
Other*	82 c/	24.0
TOTAL	182	53.0
GRAND TOTAL	347 c/	100.0

* Includes field use, pipeline use, refinery fuel and consumption in the production of carbon black.
a/ 19/
b/ 20/
c/ 21/

Since the Soviet population can be estimated at about 280 million in 1980, of which 60 percent or 168 million is to be supplied with a total of 72 billion cubic meters, this results in a per capita consumption of 430 cubic meters, or about one-half the U.S. per capita consumption in 1960.

The largest single group consuming natural gas in the USSR is the thermal electric power stations, whose share of total consumption of natural gas, although declining in recent years, is more than 2.3 times the share allocated to the communal-every-day sector. The decline in the relative share of electric power stations is to be arrested after 1965, and in 1980, the consumption of natural gas in the generation of electric power will account for almost one-half of total gas consumed by all industry. Moreover, gas consumed for this purpose will account for more than 40 percent of total gas made available to the national economy.

The second leading industrial consumer is heavy metallurgy, where the use of gas in blast furnaces, particularly in the Ukraine and in the Moscow industrial region, is becoming quite widespread. The firing of the furnaces with natural gas, according to Soviet authorities, reduced the consumption of coke per ton of pig iron by 10 to 15 percent and increased the productivity of the furnace, both combining to reduce the cost of the pig iron. Additionally, the quality of the pig iron is raised as the sulfur content declines through the reduction in use of coke.

Under the pricing system which has been in force in the Soviet Union, all household consumers in the Soviet Union pay the same price--2 kopecks per cubic meter 23/--regardless of geographical location or calorific value of the gas. For example, the household consumer in Baku, where natural gas is produced just a few kilometers away, pays the same price as the consumer in Leningrad, which is more than 2,000 kilometers distant from its major source of natural gas.

At the same time, the consumer in Leningrad might be using gas produced from shale. This gas has a relatively low calorific value, perhaps about one-third of the calorific value of the gas sold to the household consumer in Baku, yet the Leningrad consumer would be paying the same price per cubic meter.

However, industrial users do benefit from a pricing schedule which takes into consideration the cost of production of gas and the cost of transmission from the field to the consumer. In addition, certain industrial users of natural gas have been granted a privileged price so as to encourage its consumption in greater quantities.

It has been planned to reduce consumer prices for natural gas by 10 percent in 1962. 24/ This move should succeed in fulfilling its purpose of encouraging wider use of natural gas by all consumers.

Underground storage facilities at the point of consumption are of growing importance in the rapidly expanding gas industry. The first underground gas storage facility in the USSR was completed in the late 1958, near Kuybyshev. Plans for 1959-65 called for the construction of underground storage capacity near Moscow, Leningrad and Kiev, to total 2 to 3 billion cubic meters. A small facility, with a commercial capacity of 55 million cubic meters, has been established near Saratov. So far, two large facilities have been completed near Kuybyshev and total underground storage capacity in this area is about 1.5 billion cubic meters.

That more regions of the country will benefit from the construction of natural gas pipelines during the Seven Year Plan is made quite clear in Table 3-70. This Table depicts the probable consumption of natural gas by Economic Region of the USSR in 1958 and in 1965. As shown, the eastern regions of the country and the Urals industrial area, are to benefit the most from the installation of new gas pipelines. The combined share of these regions in the total consumption is to increase from 7.4 percent in 1958 to 26.5 percent in 1965 with increased consumption in the Urals providing most of the growth. Concomitantly, the share of the South is to decline from 32.7 percent to 18.7 percent. Consumption of natural gas in the South, in the Center, and in the Urals will be of comparable magnitude in 1965.

TABLE 3-70

PROBABLE REGIONAL DISTRIBUTION OF CONSUMPTION OF NATURAL GAS IN THE USSR 1958 AND 1965 PLAN

REGION	1958 a/ BCM	1958 a/ PERCENT OF TOTAL	1965 PLAN b/ BCM	1965 PLAN b/ PERCENT OF TOTAL
North	1.1	3.9	5.5 c/	3.7
Northwest	-	-	6.0	4.0
West	-	-	4.5	3.2
South	9.2	32.7	27.8	18.7
North Caucasus	2.1	7.5	12.9	8.7
Transcaucasus	4.0	14.2	11.5	7.8
Volga	5.0	17.8	13.2	8.9
Center	4.6	16.4	27.6	18.5
TOTAL EUROPEAN USSR	26.0	92.5	109.0	73.5
Urals	1.3	4.6	27.4	18.5
Eastern Regions (Kazakhstan, Central Asia, Siberia and Far East)	0.6 c/	2.1	11.9 d/	8.0
Exports	0.2	0.8	- e/	- e/
TOTAL USSR	28.1	100.0	148.3 f/	100.0

a/ Except where noted, from 25/.
b/ Except where noted, from 26/.
c/ Production.
d/ Residual.
e/ Apparently not taken into consideration by planners, but will be of the 1958 magnitude.
f/ Planned production. Although it has been estimated that the production of natural gas in 1965 will not reach this planned level, the percentage distribution may not change significantly.

SECTION 14

EXPORTS OF PETROLEUM

A. Historical Volumes

After World War II, the USSR was a negligible exporter of petroleum until the mid-1950's. It has been estimated, for example, that in 1950 total petroleum exports to both Free World and satellite countries were 1.1 million tons. 1/ In that year the Soviet Union imported 2.6 million tons of petroleum and hence was actually a net importer of 1.5 million tons (30,000 barrels per day). By 1955, however, Soviet oil trade reached a magnitude that could no longer be ignored in the compilation of world trade statistics. Table 3-71 summarizes USSR crude and product exports and imports for the years 1955 to 1961. Data for 1955 through 1960 are official Soviet trade statistics. In the absence of official Soviet statistics, the 1961 volumes have been compiled from a variety of sources and represent the agreed estimate of the committee. Total oil exports from the USSR have increased from 8 million tons in 1955 to 40 million tons (800,000 barrels per day) in 1961, for an average growth rate of 31 percent per year. Production of crude oil has been rapidly outpacing the controlled demand for oil products. In 1955, for example, net petroleum exports represented only 5 percent of production, but has represented succeedingly increasing portions of production, reaching 22 percent in 1961.

While exports were divided evenly between Free World and Bloc destinations in 1955, by 1961 65 percent of total exports went to the Free World. Exports to the Free World in 1961 amounted to 26 million tons (520,000 barrels per day). Thus about 5 percent of the petroleum demand in the Free World outside the U.S. was supplied by the USSR. This excludes petroleum exported by satellite countries to the Free World. Crude oil accounted for about one-third of oil exports from the USSR in 1955 but by 1961 represented 60 percent of the total.

Crude production is increasing more rapidly than refining facilities in the USSR, and independent and government-owned refining capacity in the Free World so far has readily absorbed the growing volumes of Soviet crude available for export. The satellite countries are also approaching self-sufficiency in refining capacity and the proportion of Soviet crude exported

TABLE 3-71

SUMMARY OF USSR TRADE IN PETROLEUM a/
1955-61
(Million Metric Tons)

	1955	1956	1957	1958	1959	1960	COMMITTEE ESTIMATE 1961
TO FREE WORLD b/							
Crude Oil	0.8	1.3	1.7	4.3	6.6	11.0	16
Products	3.2	3.9	4.7	5.3	8.0	9.7	10
TOTAL FREE WORLD	4.0	5.2	6.4	9.6	14.6	20.7	26
TO SINO-SOVIET BLOC							
Crude Oil	2.1	2.6	4.2	4.8	5.9	6.8	8
Products	1.9	2.3	3.1	3.7	4.9	5.7	6
TOTAL TO BLOC	4.0	4.9	7.3	8.5	10.8	12.5	14
TOTAL EXPORTS b/							
Crude Oil	2.9	3.9	5.9	9.1	12.5	17.8	24
Products	5.1	6.2	7.8	9.0	12.9	15.4	16
TOTAL EXPORTS	8.0	10.1	13.7	18.1	25.4	33.2	40
TOTAL IMPORTS							
Crude and Products	4.4	5.3	4.3	4.3	4.4	4.4	4
NET EXPORTS	3.6	4.8	9.4	13.8	21.0	28.8	36
NET EXPORTS (as percent of production)	5.1	5.7	9.6	12.2	16.2	19.4	21.7

a/ Except for 1961, from 2/.
b/ Includes small amounts of crude and products not accounted for in export figures to individual countries.

to the satellites will increase at the expense of finished products. Soviet imports of petroleum have remained approximately constant at 4 to 5 million tons per year, and were equivalent to about 10 percent of exports in 1961. These imports consist largely of products from Rumania together with a small amount (0.5 million tons per year) of crude oil from Austria under reparations agreements.

Petroleum represents an increasing proportion of the materials which the Soviet Union find merchantable in world markets. As shown in Table 3-72, the value of USSR petroleum exports increased from 207 million rubles in 1955 or 6.7 percent of total trade, to 592 million rubles in 1960, the latter equivalent to $657 million at the current official exchange rate, or 11.8 percent of total Soviet export trade. In the trade of the USSR with the Free World only, petroleum represented almost 20 percent of total exports. These percentages and all the other data in Table 3-72 are from official Soviet trade statistics. It should be pointed out that similar calculations (See Table 18-1) based on Free World trade statistics give somewhat different values.

Petroleum is the largest single item in Soviet export trade to the Free World and is growing more rapidly than any other. Because it is a material which must be imported by the great majority of the countries of the world, petroleum has become a medium of exchange which the USSR has in abundant supply, and the opportunity for economic and political gain through export of this commodity has not been passed by.

Table 3-73 shows the total USSR petroleum exports by country of destination for the period 1955 to 1961. In 1961 major Free World importers of Soviet oil were Italy, Cuba, Japan, West Germany, Sweden, Finland and the United Arab Republic. These countries purchased 83 percent of the total Soviet exports to the Free World. About 60 percent of Soviet total oil exports to the West are sold to Free Europe. The list of major Free World importers reflects two facets of the Soviet trade program. First, oil exports represent an important medium of exchange in countries where purchases of goods important to the Soviet economy are high (e.g. Italy, Japan, West Germany, and Sweden). Second, exports are high to countries where substantial political ties are desired (e.g. Cuba and Finland). China, Czechoslovakia, East Germany, Poland, and Hungary are the largest bloc importers of Soviet oil.

TABLE 3-72

VALUE OF USSR OIL EXPORTS IN COMPARISON WITH EXPORTS OF ALL GOODS a/
1955 - 1960

	1955		1956		1957		1958		1959		1960	
	MILLION NEW RUBLES	AS A PERCENT OF TOTAL EXPORTS	MILLION NEW RUBLES	AS A PERCENT OF TOTAL EXPORTS	MILLION NEW RUBLES	AS A PERCENT OF TOTAL EXPORTS	MILLION NEW RUBLES	AS A PERCENT OF TOTAL EXPORTS	MILLION NEW RUBLES	AS A PERCENT OF TOTAL EXPORTS	MILLION NEW RUBLES	AS A PERCENT OF TOTAL EXPORTS
TO FREE WORLD	76.6	11.8	101.6	11.8	141.8	13.7	161.0	14.8	220.0	17.9	262.0	19.7
TO BLOC	130.5	5.4	154.4	6.4	216.0	7.4	225.9	8.1	290.3	7.9	330.1	9.0
TOTAL	207.1	6.7	256.0	7.9	357.8	9.1	386.9	10.0	510.3	10.4	592.1	11.8

a/ 2/

TABLE 3-73

TOTAL USSR PETROLEUM EXPORTS BY COUNTRY OF DESTINATION
TOTAL CRUDE AND PRODUCTS EXPORTS a/
1955 - 1961
(Thousand Metric Tons)

DESTINATION	1955	1956	1957	1958	1959	1960	COMMITTEE ESTIMATE 1961
WESTERN HEMISPHERE							
Argentina	636.9	0	0	911.3	444.8	0	0
Brazil	0	0	0	0	59.4	161.4	450
Cuba	0	0	0	0	0	2,164.8	3,900
Uruguay	0	0	0	214.4	500.7	71.4	50
TOTAL TO WESTERN HEMISPHERE	636.9	0	0	1,125.7	1,004.9	2,397.6	4,400
FREE EUROPE							
Austria	37.4	26.1	57.4	60.5	526.7	605.2	200
Belgium	30.3	30.5	0.7	72.9	194.2	203.1	200
Denmark	2.1	0.6	22.7	38.7	96.5	153.4	200
Finland	612.5	1,011.8	1,214.0	1,233.7	1,856.3	2,127.9	2,200
France	269.3	408.9	551.3	710.7	807.6	785.2	700
West Germany	5.3	142.7	797.4	561.7	1,086.3	2,007.0	2,500
Greece	94.5	224.1	302.5	362.0	424.0	947.5	600
Iceland	283.3	258.9	299.8	332.2	365.4	339.2	300
Italy	183.3	500.4	502.3	1,082.0	3,035.9	4,702.5	6,000
Netherlands	10.3	15.1	0.2	103.0	47.9	40.1	50
Norway	35.5	26.1	146.8	158.0	263.3	249.1	100
Portugal	0	0	0	49.4	0	62.7	0
Sweden	725.6	694.2	536.4	870.4	1,451.4	1,968.3	2,300
Switzerland	0.1	1.2	128.6	0	39.4	28.5	50
United Kingdom	37.4	26.1	57.4	37.8	101.8	283.4	100
Yugoslavia	208.6	331.9	407.4	382.9	438.2	456.1	100
TOTAL TO FREE EUROPE	2,535.5	3,698.6	5,024.9	6,055.9	10,734.9	14,959.2	15,600
OTHER EASTERN HEMISPHERE							
Afghanistan	21.1	27.4	34.3	41.8	47.6	48.3	NA
Algeria	35.3	93.2	166.3	38.0	25.6	61.5	NA
Ethiopia	0	0	0	0	0	0.5	NA
Ghana	0	0	0	0	0	0.1	NA
Guinea	0	0	0	0	0.1	28.9	NA
India	0	0	0	0	0	23.0	250
Iran	0.5	0.2	0.3	0.3	0.3	0.5	NA
Japan	0	0	0	11.1	155.1	1,403.6	2,700
Lebanon	0	0	11.2	0	66.0	86.3	NA
Morocco	0	3.0	33.3	30.0	64.6	43.5	NA
Syria	0	26.0	30.2	270.8	448.9	273.3	NA
Tunisia	0	0	0	17.9	13.7	0	NA
Turkey	0.6	5.7	4.7	0.2	0.7	6.6	NA
Egypt	329.5	920.7	1,072.4	1,941.8	1,903.0	1,335.7	2,000
Others b/	0	0	0	0	0	0	1,050 c/
TOTAL TO OTHER EASTERN HEMISPHERE	387.0	1,076.2	1,352.7	2,351.9	2,725.6	3,311.8	6,000
TOTAL TO FREE WORLD c/	4,039.2	5,150.9	6,386.1	9,581.4	14,553.5	20,723.4	26,000
SINO-SOVIET BLOC							
Albania	8.0	10.2	4.7	5.0	9.0	5.9	Negl.
Bulgaria	118.0	164.8	381.4	422.8	558.4	821.3	1,000
China	1,589.2	1,732.3	1,802.7	2,507.2	3,048.2	2,962.8	3,000
Czechoslovakia	540.9	806.4	1,337.8	1,502.0	1,922.0	2,633.5	3,000
East Germany	653.4	749.8	1,159.8	1,123.3	1,801.7	2,167.6	2,700
Hungary	202.6	345.1	980.6	1,141.1	1,262.0	1,449.2	1,500
North Korea	130.0	163.2	179.9	226.3	244.2	217.9	(
North Vietnam	0	2.7	46.7	30.4	72.9	62.2	(500
Mongolia	61.7	78.4	74.7	80.3	119.4	129.7	(
Poland	663.5	862.8	1,326.3	1,518.2	1,780.7	2,044.2	2,300
TOTAL TO SINO-SOVIET BLOC	3,967.3	4,915.7	7,294.6	8,556.6	10,818.5	12,494.3	14,000
TOTAL TO WORLD d/	8,006.5	10,066.6	13,680.7	18,138.0	25,372.0	33,217.7	40,000

a/ Except for 1961, from 2/.
b/ Although it is known that exports were made to Israel in 1955 and 1956, they are not recorded in reference 2/.
c/ Estimate includes combined imports of indicated "other Eastern Hemisphere" countries, plus Spain, except India, Japan and Egypt.
d/ Totals include small amounts of products not accounted for in export figures to individual countries.

The recent pattern of Soviet oil exports can be seen in Table 3-74 which gives a breakdown of petroleum exports to individual importing countries by crude and type of product for 1960. Soviet official trade statistics are the basis for this table. While the Free World purchases mainly crude oil from the USSR, there is also a large market for residual fuel oils and middle distillates, apparently reflecting the ease of selling products directly to large individual Free World consumers and the policy of moving products which require a minimum amount of investment for marketing. Although the USSR has been in long supply on gasoline in recent years, a very modest amount of this product is purchased by the Free World. The small sales of gasoline are partially the result of the inability of Soviet refineries to produce gasoline which meets the quality requirements of Free World customers.

B. Predictions of Future Export Volumes

Forecasts of oil exports, even for a year as close as 1965, are extremely difficult and subject to many assumptions. While production plans are widely disseminated by the Soviet officials, historical or predicted demand figures are rarely published, and are not complete enough to prepare what might be considered an "official" estimate of consumption. In any case, forecasts of consumption are inexact even when pertinent data are readily available. Furthermore, the use of energy is under the strict control of the Soviet political-economic system. If, for example, conditions of political expediency or foreign exchange dictate greater or lesser exports of petroleum, changes in internal demand can be decreed. In addition, the political and economic climates in potential importing countries can affect the total volumes of oil which the USSR is able to market, and will surely affect, to some extent, the distribution of world purchases of Soviet oil.

Nevertheless, it is necessary to consider the question of future oil exports in order to judge the importance of Soviet oil in the world political and economic picture.

Elsewhere in this report total USSR crude requirements to meet the domestic demand for liquid products in 1965 have

TABLE 3-74

EXPORTS OF PETROLEUM FROM THE USSR, BY COUNTRY OF DESTINATION a/
1960
(Thousand Metric Tons)

DESTINATION	CRUDE OIL	GASOLINE	KEROSINE	DIESEL FUEL	RESIDUAL FUEL OIL	OTHER PRODUCTS	TOTAL PRODUCTS *	TOTAL CRUDE AND PRODUCTS
WESTERN HEMISPHERE								
Brazil	35.3	0	0	126.1	0	0	126.1	161.4
Cuba	1,648.5	54.0	21.9	31.8	388.9	18.1	516.3	2,164.8
Uruguay	15.0	0	0	17.7	38.7	0	56.4	71.4
TOTAL TO WESTERN HEMISPHERE	1,698.8	54.0	21.9	175.6	427.6	18.1	698.8	2,397.6
FREE EUROPE								
Austria	530.7	0	0	0	0	0	74.5	605.2
Belgium	0	0	0	34.9	168.2	0	203.1	203.1
Denmark	0	0	0	0.9	151.7	0	153.4	153.4
Finland	766.5	33.8	12.5	655.3	653.0	6.8	1,361.4	2,127.9
France	132.3	76.6	0	318.6	257.7	0	652.9	785.2
West Germany	1,240.9	73.5	0	545.6	140.1	0	766.1	2,007.0
Greece	423.7	1.8	0.5	165.9	355.2	0	523.8	947.5
Iceland	0	41.7	0	186.6	110.9	0	339.2	339.2
Italy	3,921.0	0	0	6.0	774.0	1.5	781.5	4,702.5
Netherlands	0	0	0	37.9	1.8	0	40.1	40.1
Norway	0	0	0	32.1	216.4	0.6	249.1	249.1
Portugal	0	0	0	62.7	0	0	62.7	62.7
Sweden	0	0	10.1	417.4	1,537.8	0.8	1,968.3	1,968.3
Switzerland	0	0	0	0	28.5	0	28.5	28.5
United Kingdom	0	0	0	25.8	177.2	35.4	283.4	283.4
Yugoslavia	351.5	13.7	0	82.8	8.1	0	104.6	456.1
TOTAL TO FREE WORLD	7,366.6	241.1	23.1	2,572.5	4,580.6	45.1	7,592.6	14,959.2
OTHER EASTERN HEMISPHERE								
Afghanistan	0	37.9	2.7	3.4	0.3	4.0	48.3	48.3
Algeria	0	0	0	41.4	20.1	0	61.5	61.5
Ethiopia	0	0	0.5	0.2	0.3	0	1.0	1.0
Ghana	0	0	0	0	0	0	0.1	0.1
Guinea	0	15.1	2.5	0.8	0	0	28.9	28.9
India	0	0	0	0	0	0	23.0	23.0
Iran	0	0	0	0	0	0.5	0.5	0.5
Japan	1,183.7	0	0	138.1	81.8	0	219.9	1,403.6
Lebanon	0	0	0	0.9	85.4	0	86.3	86.3
Morocco	43.5	0	0	0	0	0	0	43.5
Syria	0	0.5	0	272.3	0	0	273.3	273.3
Turkey	0	0	0	0	6.6	0	6.6	6.6
Egypt	699.9	3.2	238.6	155.8	237.1	0	635.8	1,335.7
TOTAL TO EASTERN HEMISPHERE	1,927.1	56.7	244.3	612.9	431.6	4.5	1,385.2	3,312.3
TOTAL TO FREE WORLD	10,992.5	351.8	289.3	3,361.0	5,439.8	67.7	9,730.9	20,723.4 a/
SINO-SOVIET BLOC								
Albania	0	0	0	0	0	5.9	5.9	5.9
Bulgaria	0	291.9	65.1	305.4	116.6	42.3	821.3	821.3
China	567.6	1,055.2	386.2	708.8	0	221.9	2,395.2	2,962.8
Czechoslovakia	2,355.3	127.4	148.4	0	0	2.4	278.2	2,633.5
East Germany	1,780.4	176.6	122.5	85.7	0	2.4	387.2	2,167.6
Hungary	1,393.4	0	0	0	48.8	7.0	55.8	1,449.2
North Korea	0	119.0	2.4	63.4	2.4	29.8	217.9	217.9
North Vietnam	0	22.8	10.6	24.1	0	4.7	62.2	62.2
Mongolia	25.1	51.0	0.1	44.7	0	8.2	104.6	129.7
Poland	710.6	589.5	50.0	506.9	166.8	20.4	1,333.6	2,044.2
TOTAL TO SINO-SOVIET BLOC	6,832.4	2,433.4	785.3	1,739.0	334.6	345.0	5,661.9	12,494.3
TOTAL TO WORLD	17,824.9	2,785.2	1,074.6	5,100.0	5,774.4	412.7	15,392.8	33,217.7

* Individual products do not always add up to total, since totals include some unknown.

been estimated at 200 million tons.* This estimate is consistent with total estimated energy demand and availability in the USSR in 1965, as discussed in Chapter 1 above. Current best estimates of the available supply from which the probable requirement of 200 million tons may be drawn are 265 million tons of crude production and a total of 5 million tons of natural gas liquids and synthetics. On this basis, the USSR will have available 70 million tons of petroleum for net export. If to this net export is added an estimated 3 million tons of petroleum imports, total petroleum available for export in 1965 may reach 73 million tons (1.46 million barrels per day).

This estimate is consistent with Soviet statements concerning potential oil exports. In 1960 the U.S. Oil Industry Delegation which visited the USSR questioned Mr. E. P. Gurov on Soviet plans for exporting oil. Mr. Gurov stated that Soviet exports will not decrease. He estimated that they "might continue to increase from 15 to 20 percent per year." 4/ If this percentage increase is applied to official Soviet statistics of total oil exports in 1960, the 1965 volume would range from 67 to 83 million tons.

An estimate of a possible regional breakdown of potential 1965 Soviet oil exports is given in Table 3-75. This breakdown also is compared with estimated 1961 imports for these regions. Estimates for 1965 were derived from an analysis of past trends in imports of USSR and Soviet bloc crude and products by these regions, as well as their total oil demand patterns, their potential facilities for handling Soviet bloc petroleum, and long-term East-West trade agreements which are currently in effect or are likely to be reached. Table 3-75 shows that exports to the satellites may increase to 27 million tons by 1965, and exports available for the Free World may reach 46 million tons. The bulk of the increase will be in the form of crude oil. The satellite countries will receive two and one-half times as much crude as they did in 1961, reflecting a substantial refinery expansion program as well as a greatly improved transportation system with the completion of the Comecon pipeline. About 5 million tons of petroleum products will be available in the satellite countries for export to the Free World as discussed in a later section.

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* See Page 173.

TABLE 3-75

POSSIBLE 1965 DISTRIBUTION OF
PETROLEUM EXPORTS FROM THE USSR, COMPARED
WITH 1961
(Million Metric Tons)

DESTINATION	1961 CRUDE	1961 PRODUCTS	1961 TOTAL	1965 CRUDE	1965 PRODUCTS	1965 TOTAL
TO BLOC						
East Europe	7	3	10	18	2	20
Far East	1	3	4	3	4	7
Total	8	6	14	21	6	27
TO FREE WORLD						
North Europe	2	5	7	4	9	13
West and Central Europe	1	1	2	1	3	4
South Europe and North Africa	8	1	9	8	4	12
Other Africa and Far East	2	2	4	8	2	10
Western Hemisphere	3	1	4	6	1	7
Total	16	10	26	27	19	46
TOTAL EXPORTS	24	16	40	48	25	73
TOTAL IMPORTS	0.5	3.5	4	0	3	3
NET EXPORTS	23.5	12.5	36	48	22	70
NET EXPORTS (AS PERCENT OF PRODUCTION)	-	-	22	-	-	26

Fifty-five percent of the Free World imports from the USSR will be crude as compared with about 62 percent in 1961.

The potential exists for major increases in Soviet oil imports by the North European area and the underdeveloped nations of Africa and the Far East. The actual pattern of imports by the Free World regions in 1965 will depend on economic, political and strategic situations in the individual countries involved. An analysis by the Committee has shown, however, that pressures by the USSR to export these quantities will be strong, and that facilities of those customers in the Free World who are likely to be willing purchasers are adequate to absorb the available amount.

Exportable surplus beyond 1965 is difficult to predict at this time. However, application of consumption growth rates presented in a long range study of the probable demand for petroleum products in the USSR by 1972-75, developed by Gosplan and published in late 1959, yields a rough approximation of demand for this period. According to this study, consumption of petroleum products in 1972-75 was to be 3.98 times consumption in 1958. Thus, using this growth factor, it may be estimated that consumption in 1972-75 may approach 360 million tons.

This points out the strong probability that continued, and growing, exportable surpluses of petroleum may be available at least through 1975, as elsewhere in this report it has been noted that current Soviet plans call for the production of crude oil to reach 390 million tons in 1970 and 545 million tons in 1975. Interpolating between these production goals would indicate a production of perhaps 450 million tons in 1972. Relating this to the rough approximation of domestic demand of 360 million tons for 1972-75 would indicate that the USSR is planning an exportable surplus of considerable magnitude--perhaps from 90 million to 185 million tons per year in the period 1972-75. This compares to the exportable surplus of 70 million tons forecast in this study for 1965.

Admittedly, such an estimate is very rough; however, the extremely high targets for energy production in 1970 and 1980, the immense untapped petroleum reserves within the border of the country, and the past experience of the Soviet Union in meeting or exceeding oil production targets, all seem to indicate that there is every reason to expect that the export potential will continue to increase.

C. Pricing

1. Soviet Petroleum Export Prices, 1955-1960

Recent statistics of Soviet trade published by the USSR provide a basis for discussion of the Soviet policies of pricing petroleum in the years 1955 through 1960. Table 3-76 lists average f.o.b. export prices for crude oil charged by the USSR to Free World and satellite customers for these years. These prices, converted to U.S. dollars per barrel at the official conversion of 1.11 dollars per ruble, assuming 7.3 barrels of crude per ton, are shown graphically on Figure No. 11.

TABLE 3-76

AVERAGE EXPORT PRICES FOR SOVIET CRUDE OIL a/ - 1955-60 (Rubles Per Metric Ton)

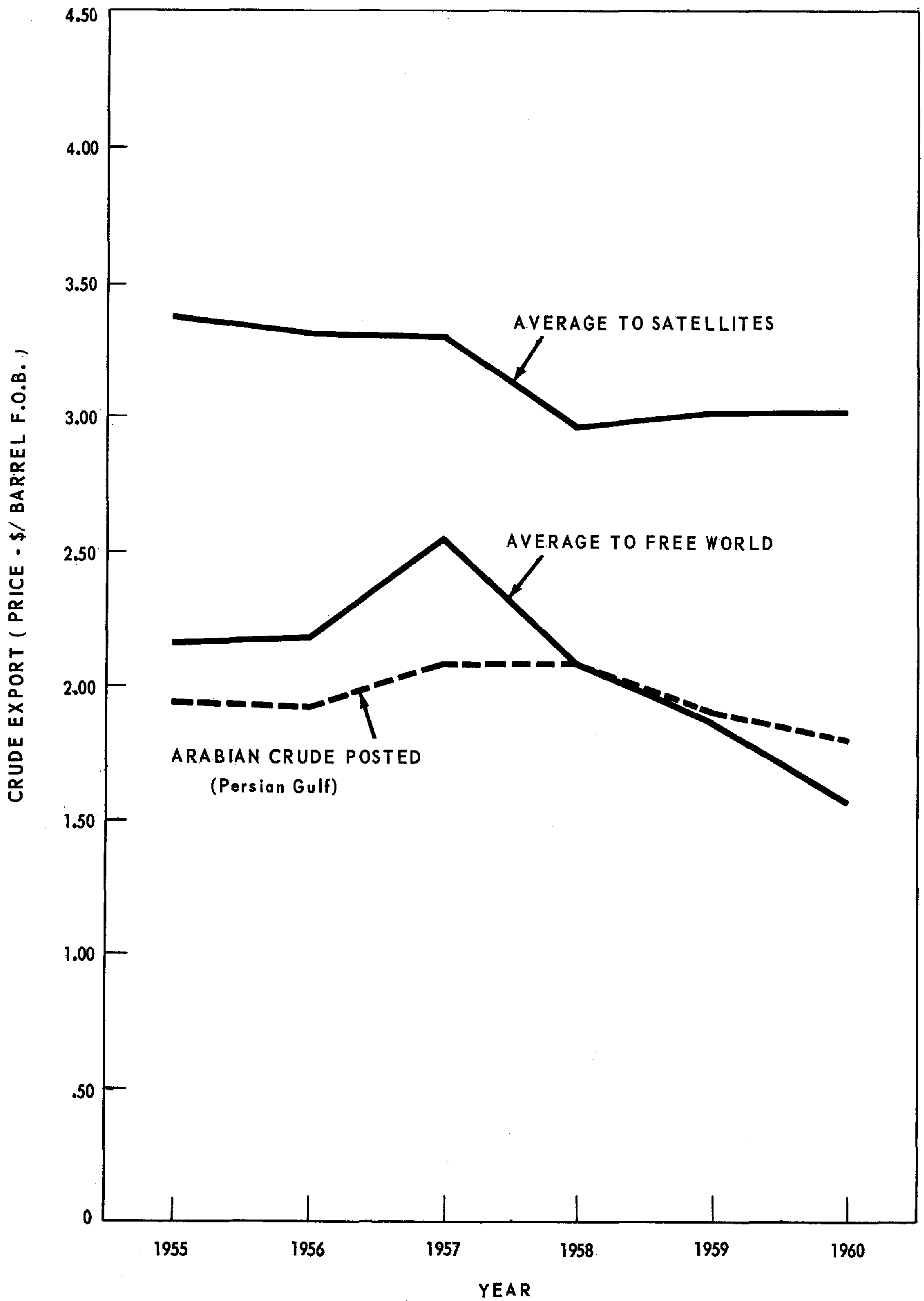
YEAR	TO FREE WORLD	TO SATELLITES
1955	14.2	22.2
1956	14.3	21.7
1957	16.8	21.6
1958	13.7	19.5
1959	12.4	19.8
1960	10.3	19.8

a/ 5/

The two lower curves on Figure No. 11 compare export prices at the Soviet border with prices posted for an Arabian crude at the Persian Gulf. It can be seen that in 1955 and 1956 the Soviet f.o.b. prices were some 20 cents higher than Persian Gulf posted prices--a differential approximately equal to the higher transportation cost in reaching European markets from the Persian Gulf than from the Black Sea. In 1957, reflecting the tighter supply-demand situation during the Suez Canal crises, prices rose for both sources. Following 1957, however, as the USSR had more and more crude oil available for Free World markets, Soviet prices dropped rapidly. In 1960, for example, the USSR charged an average of only $1.56 per barrel to her Free World customers compared with a Persian

Figure No. 11

USSR CRUDE EXPORT PRICES



SOURCE: "1955-1959 FOREIGN TRADE OF THE USSR," MOSCOW, 1961

"1960 FOREIGN TRADE OF THE USSR," MOSCOW, 1961.

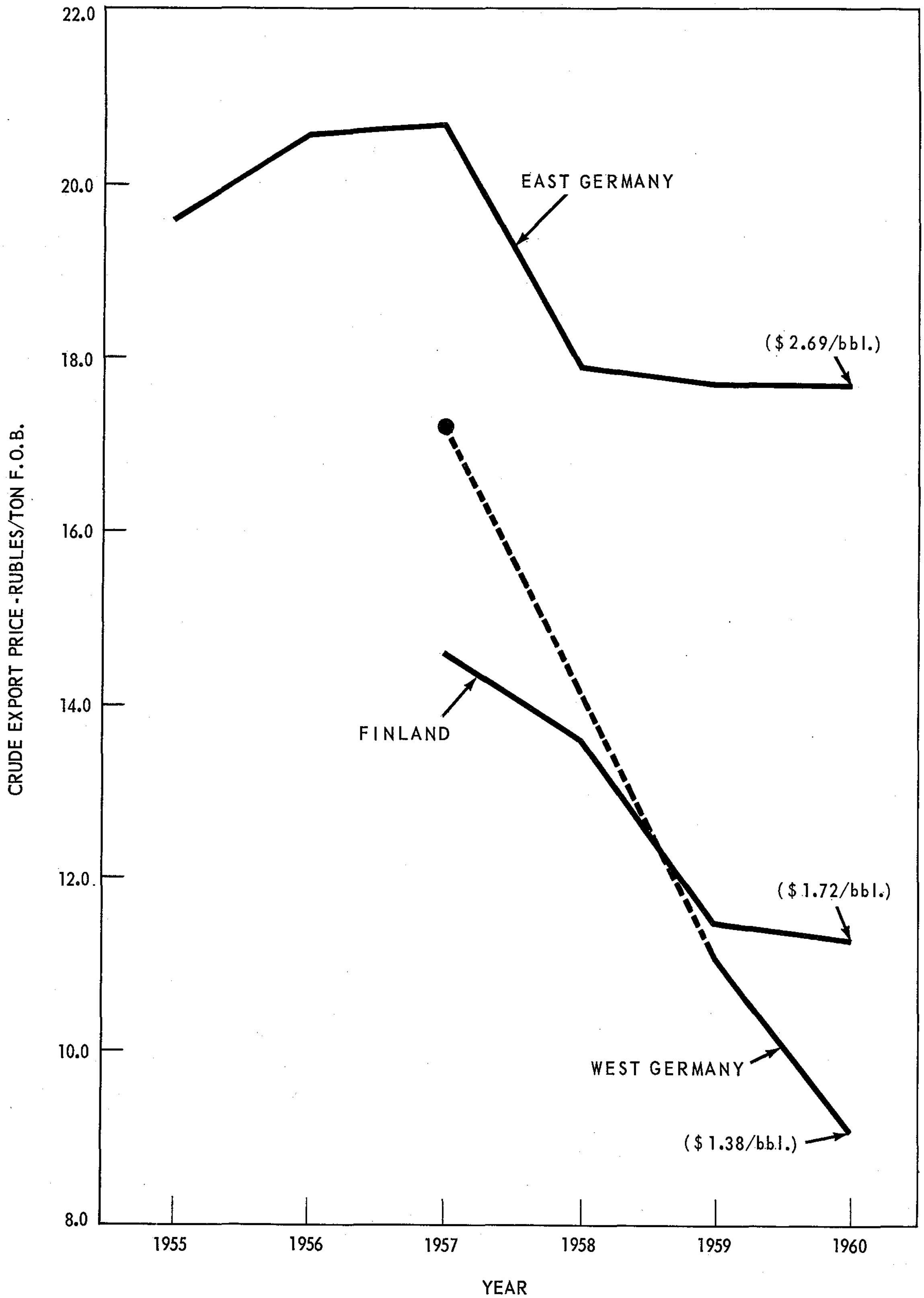
Gulf posting of $1.80 for the Arabian crude. The price to the Free World of $1.56, if netted back from Southern Europe to the Persian Gulf, would be equivalent to a Gulf sale price of only about $1.25-$1.30 per barrel, a price which the Free World oil producers were unable to meet for crude of equivalent quality. Since oil represents a valuable medium of exchange to the USSR, probably it is fair to assume that in most cases the low f.o.b. prices for Soviet crude represent levels that it was necessary to reach in order to find sufficient customers in a market which is suspicious of the reliability of oil from Communist sources.

At the same time the Soviet traders were making crude available at very attractive prices to Free World customers, advantage was taken of the captive markets in the satellite countries. The upper curve on Figure No. 11 shows average f.o.b. prices for crude sales to the satellites including Communist China. These countries on the average have been paying premiums ranging from 56 percent in 1955 to a minimum of 29 percent in 1957 and a maximum of 92 percent in 1960, over and above prices charged the Free World. Although the satellites have been permitted some reduction in payment as Soviet oil production costs have improved, their average prices have dropped only from $3.37 per barrel in 1955 to $3.01 per barrel in 1959 and 1960.

The practice of charging a captive market as much premium as the traffic will bear is illustrated further by comparing crude prices to specific countries. Figure No. 12 shows published f.o.b. charges in rubles per ton to East Germany, West Germany and Finland. These countries are in the same geographical area and transportation cost differences to the USSR border may be assumed to be insignificant. West Germany, which can be considered to have complete freedom of choice in selecting its suppliers, is currently paying the lowest price of the three. Finland, with ties which commit its economy largely to the USSR, is paying somewhat more, and East Germany, which has no choice but to conform to the overall Communist plan, is paying by far the most. Figure No. 13, which compares Italy, Yugoslavia and Hungary, shows the same effect. Relative prices shown in Figure No. 14, which compares Communist China and Japan, must be a source of considerable annoyance to the Chinese, in that the price paid by Communist China is more than double that paid by Japan.

Figure No. 12

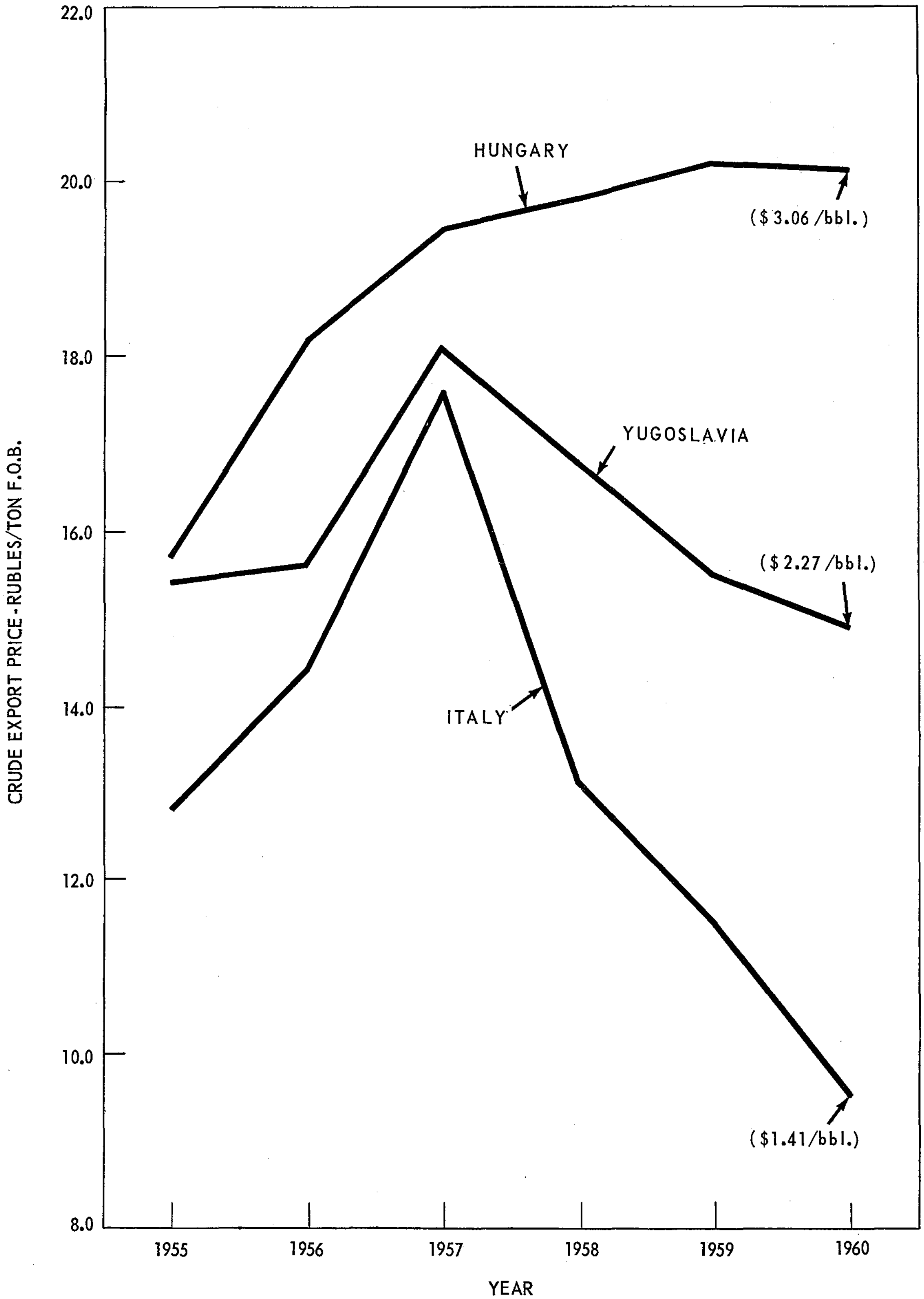
USSR CRUDE EXPORT PRICES TO SELECTED BALTIC COUNTRIES



SOURCE: "1955-1959 FOREIGN TRADE OF THE USSR," MOSCOW, 1961.
"1960 FOREIGN TRADE OF THE USSR," MOSCOW, 1961.

Figure No. 13

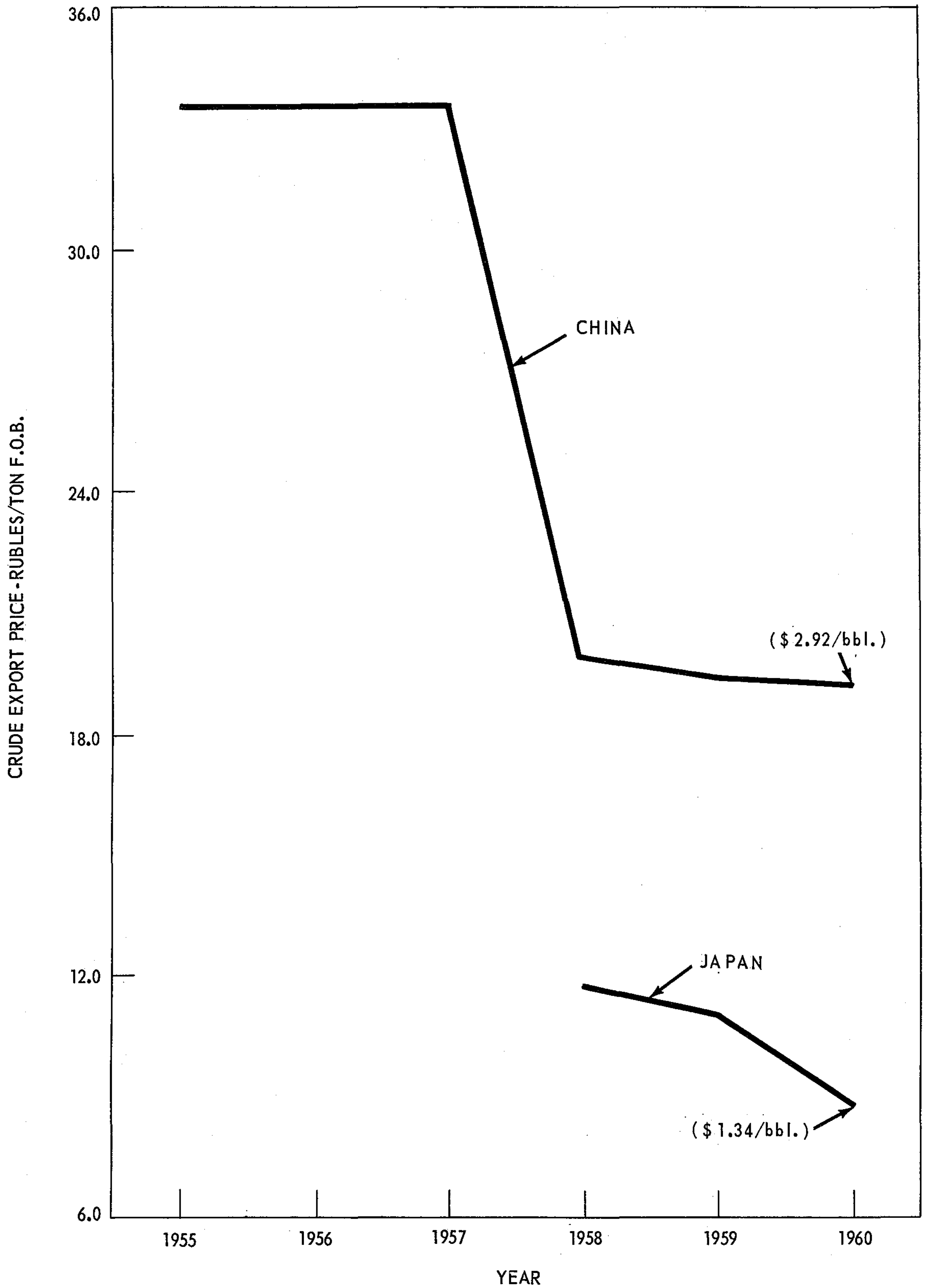
USSR CRUDE EXPORT PRICES TO SELECTED SOUTH EUROPEAN COUNTRIES



SOURCE: "1955-1959 FOREIGN TRADE OF THE USSR," MOSCOW, 1961.
"1960 FOREIGN TRADE OF THE USSR," MOSCOW, 1961.

Figure No. 14

USSR CRUDE EXPORT PRICES TO SELECTED FAR EAST COUNTRIES



SOURCE: "1955-1959 FOREIGN TRADE OF THE USSR," MOSCOW, 1961.
"1960 FOREIGN TRADE OF THE USSR," MOSCOW, 1961.

There is considerable inconsistency between f.o.b. prices to various satellites as well as to individual Free World countries. Figure Nos. 12, 13 and 14 show that in 1960, Italy was charged $1.41 per barrel f.o.b., Japan $1.34 per barrel, West Germany $1.38 per barrel, Finland $1.72 per barrel, and Yugoslavia $2.27 per barrel. In the same year East Germany paid $2.69 per barrel, Hungary $3.06 per barrel, and China $2.92 per barrel.

An outstanding exception to the Soviet exploitation of captive markets is provided by Cuba.* During the portion of the year in which she imported Soviet oil, Cuba was completely dependent on the USSR for her petroleum supply, and, in fact, for essentially her entire economy. Even so, the average f.o.b. price for crude oil to Cuba in 1960 was $1.54 per barrel, which was slightly less than the average Free World price and substantially less than the prices charged such countries as Finland and Yugoslavia.

A comparison of product prices is more difficult because information on the relative qualities of various products sold is usually not sufficient to permit accurate analysis. However, Figure No. 15, which gives heavy fuel oil prices to selected Free World and satellite countries in the Baltic Sea region, shows the same general trend, as does Table 3-77, which lists average prices for all major product categories for 1959 and 1960.

The Soviet policy of charging substantially higher prices for commodities to its satellites than to the Free World apparently is not limited to oil. In 1958, for example, the prices for 23 of the 49 Soviet articles exported to the satellite countries were higher than those charged to Western countries, while prices of only 3 articles were higher for West Europe than for the satellites. 6/ In 1960, of the 51 articles which were sold both to East Europe and West Europe, the average prices charged the captive nations were higher than those charged West Europe in 41 cases and lower in 10 cases. 7/

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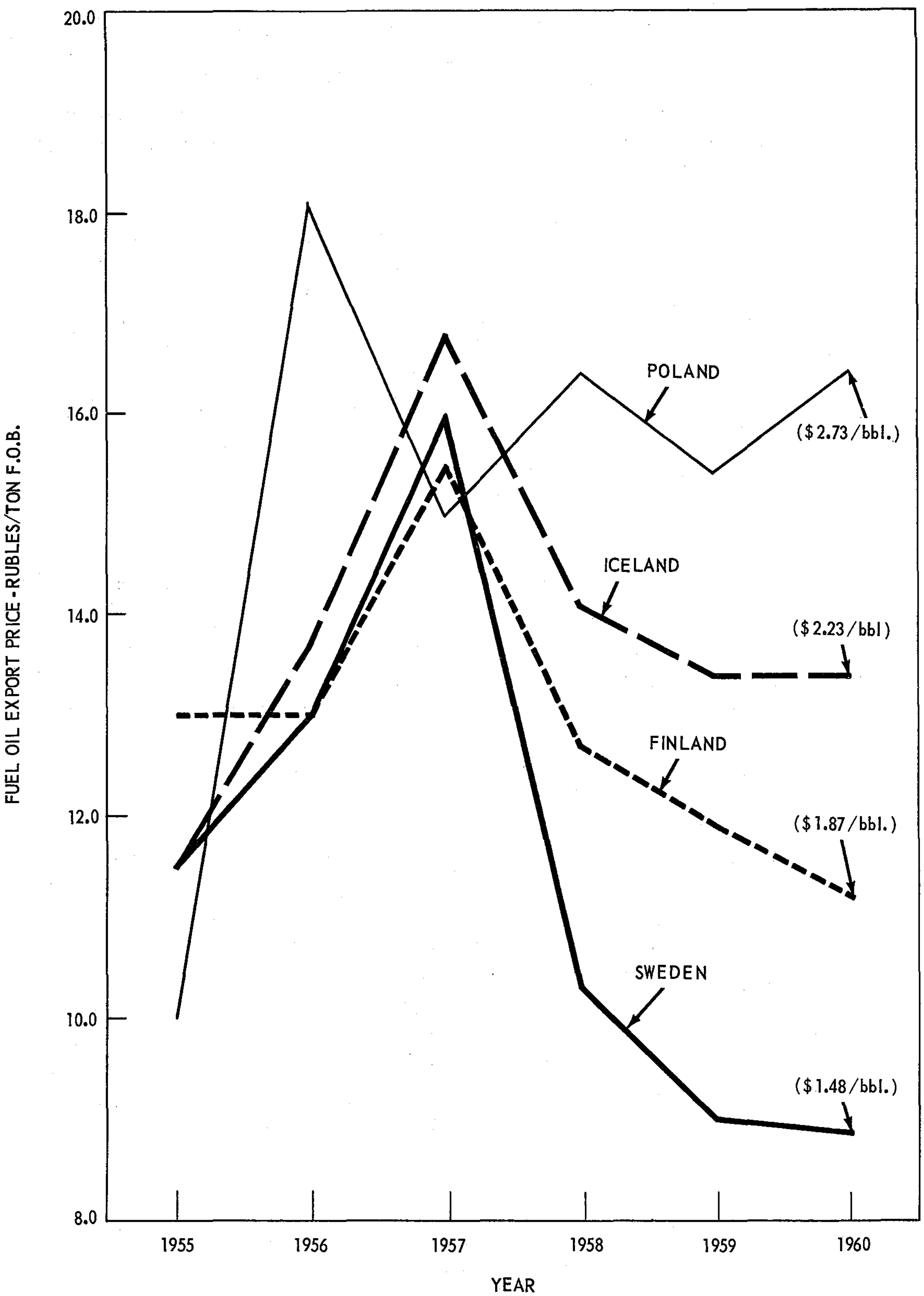
* In this report, Cuba is considered to be a Free World, although a captive customer.

Figure No. 15

USSR HEAVY FUEL OIL EXPORT PRICES

TO SELECTED NORTH EUROPEAN COUNTRIES



SOURCE: "1955-1959 FOREIGN TRADE OF THE USSR," MOSCOW, 1961.
"1960 FOREIGN TRADE OF THE USSR," MOSCOW, 1961.

TABLE 3-77

COMPARISON OF SOVIET EXPORT PRODUCT PRICES TO FREE WORLD AND SATELLITES, BY TYPE OF PRODUCT a/ - 1959-60
(F.O.B. Rubles Per Metric Ton)

TYPE OF PRODUCT	1959 PRICES TO FREE WORLD	1959 PRICES TO SATELLITES	1960 PRICES TO FREE WORLD	1960 PRICES TO SATELLITES
Gasoline	33.7	35.3	28.8	34.9
Kerosine	24.8	30.9	23.9	30.7
Distillates	22.6	29.3	20.1	29.3
Heavy Fuel Oil	10.1	14.8	9.6	14.6

a/ 8/

It thus appears that in the case of oil and probably other commodities, the satellite countries of the Soviet Bloc are subsidizing Soviet costs to permit attractive prices to the Free World. Even though there may be offsetting compensations in other commodity arrangements within the Bloc, the subsidy Soviet oil obtains must help its oil industry show a reasonable performance in spite of the cut-price sales to the Free World.

2. Recent Price Trends

Official export prices for periods more recent than 1960 have not been published in the Soviet open literature. However, spot data available in the Free World indicate that the policy of setting prices at whatever level is necessary to more available oil is continuing. Tables 3-78 and 3-79 list recently available data on prices charged Free World purchasers. Crude prices appear to be continuing their downward trend. It is reported that the bulk of Soviet crude oil deliveries to Italy in 1962 will sell at $1.08 per barrel, equivalent to only $0.85 per barrel if netted back to the Persian Gulf. Other deliveries to Italy will be at the equivalent of about $1.27 to $1.39 f.o.b. Black Sea. Sales to Japan in late 1961 were equivalent to about $1.00 to $1.15 per barrel f.o.b. Black Sea, or less, whereas 1961 and 1962 sales to West Germany are equivalent to about $1.30 at the Black Sea. A recent press release 9/stated that the Soviet oil export organization announced that the price of Soviet crude to Japanese independent purchasers on

TABLE 3-78

PRICE INFORMATION-IMPORTS OF SOVIET CRUDE OIL
(LATE 1961 - 1962)

IMPORTING COUNTRY	DELIVERY DATE	TYPE OF CRUDE	GRAVITY API	PERCENT SULPHUR	QUANTITY (THOUSAND BARRELS)	F.O.B. BLACK SEA ($/BARREL)	C.I.F. ($/BARREL) a/	ESTIMATED EQUIVALENT PERSIAN GULF F.O.B. ($/BARREL)	APPROXIMATE EQUIVALENT PERSIAN GULF POSTING ($/BARREL)
ITALY	1962	Tuymaza	37.0 - 39.0	NA	7,000	-	1.48	1.05	1.88 b/
	1962	Tuymaza	NA	NA	1,000	-	1.60	1.17	-
	1962	Tuymaza	NA	NA	22,000	1.08	-	0.85	-
	1962	Tuymaza	NA	NA	5,000	-	1.50	1.07	-
	End 1961	Tuymaza	NA	NA	700	-	1.50	1.07	-
WEST GERMANY	December 1961	Tuymaza	36.9	1.40	800	-	1.72	1.13	1.84 b/
	January 1962	Tuymaza	NA	NA	873	-	1.68	1.09	-
AUSTRIA	1962	Tuymaza + Sokolovo	32.5 - 35.5	0.60 - 1.50	138	-	2.23	-	1.80 b/
JAPAN	October 1961	Sokolovo	37.0	0.44 - 0.47	557	-	1.93	1.49	1.86 b/
	October 1961	Mukhanova	37.6	0.48	173	-	2.06	1.62	1.86 b/
	October 1961	Tuymaza	34.8	1.26	173	-	2.00	1.55	1.80 b/
	October 1961	Ekhabi (Sakhalin)	32.0 - 33.0	0.28 - 0.33	277	-	1.94	1.48	1.61 c/
	November 1961	Mukhanova	38.2	0.55	324	-	1.90	1.46	1.88 b/
	November 1961	Sokolovo	37.0 - 38.0	0.48 - 0.52	540	-	1.91	1.47	1.86 b/
	November 1961	Mukhanova	40.6	0.79	179	-	2.02	1.59	-
	November 1961	Tuymaza	34.8	1.37	242	-	2.00	1.55	1.80 b/
	November 1961	Ekhabi (Sakhalin)	32.6	0.30	70	-	1.95	1.49	1.61 c/
	November 1961	Turkmen	31.8	0.41	236	-	1.93	1.47	1.59 c/
	December 1961	Mukhanova	38.2	0.54	141	-	1.93	1.49	1.88 b/
	December 1961	Mukhanova	40.3	0.89	186	-	2.03	1.60	-
	December 1961	Turkmen	33.0	0.46	281	-	1.95	1.49	1.63 c/
	December 1961	Sokolovo	37.0	0.50	218	-	1.92	1.48	1.86 b/
	December 1961	Sokolovo	38.3	0.50	205	-	1.90	1.46	1.88 b/
	December 1961	Tuymaza	34.2	1.46	177	-	2.01	1.56	1.80 b/
BRAZIL	1962	Romashkino	33.0	1.50					
		Mukhanova	34.0 - 34.9	0.57	5,180	-	2.10	1.40	1.80 b/
		Tuymaza	34.0 - 34.9	1.57					

a/ Reported C.I.F. price netted back to Ras Tanura at Scale #3 minus 50 percent.
b/ Arabian crude at $1.80 per barrel for 34.0 - 34.9° API, escalated at 2¢ per barrel per full degree increase in °API.
c/ Kuwait crude at $1.59 per barrel for 31.0 - 31.9° API, escalated at 2¢ per barrel per full degree increase in °API.

TABLE 3-79

PRICE INFORMATION-IMPORTS OF SOVIET PETROLEUM PRODUCTS (LATE 1961 - 1962)

IMPORTING COUNTRY	DELIVERY DATE	TYPE OF PRODUCT	QUALITY	QUANTITY (THOUSAND BARRELS)	PRICE	
					F.O.B. BLACK SEA ($/BARREL)	C.I.F. ($/BARREL)
JAPAN	October 1961	Fuel Oil	Bunker C	46		2.38
	October 1961	Fuel Oil	Bunker C	20		2.51
	October 1961	Distillate	Heating oil containing some residual	20		3.49
	November 1961	Fuel Oil	Bunker C	47		2.37
	November 1961	Distillate	Heating oil containing some residual	27		3.49
	December 1961	Fuel Oil	Bunker C	418		2.41
		Distillate	Heating oil containing some residual	182		3.38
SWEDEN	1961	Fuel Oil	2.0-2.15% S	13,700		1.65-1.88
	January 1962	Fuel Oil	2.0-2.15% S	NA		1.83
	January 1962	Fuel Oil	Bunker C	NA		1.81
NORWAY	January 1962	Gas Oil	56-58	116		3.40
DENMARK	January 1962	Fuel Oil	2.5-2.7% S	79		1.81
ITALY	1961	Fuel Oil	2.5% S	3,700		1.60
WEST GERMANY	December 1961	Gasoline	87-90 O.N.	60		3.02
	December 1961	Gas Oil	48/53	133		3.00
	December 1961	Fuel Oil	Low S	71		2.18
	January 1962	Gasoline	87-90 O.N.	NA		3.03
	January 1962	Gas Oil	48/53	NA		3.25
	January 1962	Fuel Oil	Low S	NA		1.82
BRAZIL	1961	Diesel Oil	48-52	1,000	3.10	
FINLAND	1961	Turbo Fuel	(1-A)	20	3.66 a/	
	1961	Kerosine	(Illuminating)	96	3.66 a/	
	1961	Gas Oil	53/57 14° F Pour	1,151	3.32 a/	
	1961	Distillate	48/52 5° F Pour	1,222	3.28 a/	
	1961	Distillate	43/47 -31° F Pour	1,492	3.32 a/	
	1961	Distillate	43/47 -49° F Pour	239	3.41 a/	
	1961	Residual Fuel	(Bunker C)	3,699	1.78 a/	

a/ Calculated from Price Base Platt's Low Aruba less discounts.

short-term contracts would be raised by $1.00 per ton (14 cents per barrel). However, resistance by Japanese purchasers has resulted in a reduction of this proposed increase in at least one instance.

Product prices appear to be showing varying trends. Bunker C was sold to Finland at $1.87 per barrel f.o.b. in 1961, compared with an average f.o.b. price to Finland of $1.87 per barrel for fuel oil in 1960. In Sweden, on the other hand, some fuel oil was imported from the USSR at prices as low as $1.65, c.i.f., in 1961, while 1962 quotations are $1.81 and $1.83 per barrel c.i.f. The latter quotation would be about $1.70 netted back to Klaipeda, or about $1.40 netted back to the Black Sea, compared with the Soviet published average of $1.48 per barrel f.o.b. in 1960. Japan apparently pays a premium for Soviet fuel oil over Middle East equivalent prices. It is not clear whether this higher price is the result of a quality advantage for the Soviet fuel, although it is known that much of the fuel oil Japan purchases from the USSR has lower sulfur content than Middle East fuels.

3. Comparison of Export Prices With Production and Transportation Costs

Data published by the USSR are available to permit a rough comparison between the f.o.b. sales prices and the cost of production and transportation to Soviet export points. The production costs reported by the USSR have obvious deficiencies for use in any analysis, as discussed in the section on Producing. The analysis is also complicated by the fact that reported crude production costs vary widely between fields (from 32 percent of the national average in Mukhanova to 331 percent of the national average in Sakhalin), and that the petroleum industry is known to use a number of alternative transportation routes which also show many-fold variations in cost to export points. In addition, there is considerable doubt whether the rubles in which sales prices are reported are equivalent to the rubles for reported costs, as discussed below. However, the analysis indicates that under favorable conditions the total cost of laying down crude or products at export points is apparently less than sales price, thereby permitting a profit, but under the less favorable marginal conditions, expenses are actually much higher than f.o.b. sales prices.

Some examples are shown in Table 3-80. In this table, production costs are based on Soviet published figures for 1960,

TABLE 3-80

COSTS OF LAYING DOWN
SOVIET CRUDE OIL AT EXPORT POINTS

PRODUCTION COST a/ (RUBLES/ METRIC TON)	PRODUCTION POINT	TRANSPORTATION COST (RUBLES/ METRIC TON)	TRANSPORTATION MEANS	TOTAL COST (RUBLES/ METRIC TON)	COMPARABLE FOB SALE (RUBLES/ METRIC TON)	APPARENT "PROFIT" (RUBLES/ METRIC TON)*	REMARKS
4.5	National Average	5.3	Rail, Kuybyshev to Tuapse	9.8	10.3 b/	0.5	Major portion of crude exports to Free World known to be Urals-Volga crude exported via Black Sea.
3.2	Tuymaza	3.7	Pipeline, Kuybyshev to Stalingrad, then rail to Tuapse	6.9	8.8 c/	1.9	Tuymaza type crude known to be exported to Italy via Black Sea.
4.5	National Average	6.8	Rail, Kuybyshev to Klaipeda	11.3	9.1 d/	- 2.1	Crude sales to Germany known to be Tuymaza crude exported from Klaipeda; believed to be transported by rail.
3.2	Tuymaza	6.8	Rail, Kuybyshev to Klaipeda	10.0	9.1 d/	- 0.9	
14.9	Sakhalin	negl.	-	14.9	12.1 e/	- 2.8	Sakhalin crude known to be imported by Japan.

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* A minus (-) sign indicates an apparent loss.
a/ All production costs based on 1960 USSR average, plus 40 percent to allow for geological, geophysical, exploration, and sales costs not included in official data.
b/ 1960 average export price to Free World, from 10/.
c/ Based on reported 1962 price of $1.08/barrel, f.o.b. sales to Italy.
d/ 1960 export price to West Germany, from 11/.
e/ Estimated from 1961 C & F import prices in Japan as published by MITI.

but have been increased by 40 percent to cover geological, geophysical, exploration, and sales costs which are not included in the Soviet costs of production. Rail transportation is estimated at 0.326 kopecks per ton-kilometer and pipeline costs at 0.12 kopecks per ton-kilometer. These values are the Soviet average for petroleum transport in 1958, as discussed in another section of this report.

Table 3-80 shows that if the cost of production is taken at the national average of 4.5 rubles per ton and transportation is assumed by rail from the Urals-Volga area to Tuapse on the Black Sea, the total cost of laying down crude at Tuapse is 9.8 rubles per ton. Compared with the average 1960 export price of 10.3 rubles per ton to the Free World this permits a modest "apparent profit" of 0.5 rubles per ton, or slightly under 5 percent of the sales price. If allowance is made for the fact that Tuymaza crude is produced at a lower cost than the national average, and assuming a relatively low transportation cost by the existing pipeline from Kuybyshev to Stalingrad, an apparent profit of 1.9 rubles per ton can be made, even on the relatively low reported price of 8.8 rubles per ton for f.o.b. Black Sea sales to Italy in 1962. However, certain of the sales result in substantial losses to the petroleum industry. For example, Tuymaza crude which is sold to West Germany by way of Klaipeda on the Baltic Sea, apparently costs from 0.9 to 2.1 rubles per ton more to produce and transport by rail to Klaipeda than is realized in sales price. Because of the relatively high production cost of crude in Sakhalin, f.o.b. sales price to Japan for this crude falls short of actual production cost by nearly 3 rubles per ton.

It may be concluded that, on the basis of costs published by the USSR, crude sales to the Free World probably permit a profit to the Soviet oil industry on the average, although some specific sales are, no doubt, made at a loss. Sales made by the USSR to the Free World at the current level of prices could not support royalty and tax payments of a magnitude approaching those made by Free World producers to the governments of the major producing countries. The satellite countries of the Bloc, however, are paying the equivalent of very large royalties to the Soviet oil industry. Completion of currently planned pipeline systems within the USSR will greatly improve the profits accruing to the Soviet oil industry.

The comparison between sales price and producing and transportation costs cannot be considered a rigid one. The major weakness in the analysis is that while f.o.b. prices are reported in rubles, actual sales are usually made in sterling, dollars, or in the currency of the importing countries. Thus, most export prices quoted in Soviet statistics have been converted from other currencies at the official conversion rate established by the Soviet Union. Official conversions may not reflect the true value of the ruble in terms of what the ruble can buy in the USSR, and consequently may not be consistent with reported ruble costs. But by far the over-riding factor in determining whether the oil trade is profitable to the Soviet Union lies in the type of goods which she is receiving in trade in return. As discussed in other sections of this report, there is no doubt that the USSR on the average is receiving relatively high-value materials in payment for her oil; and that the trade should be considered "profitable" to the USSR.

PART FOUR

THE EUROPEAN SATELLITES

CHAPTER IV

SUMMARY OF ENERGY DEVELOPMENTS
EUROPEAN SATELLITES

CHAPTER IV

SUMMARY OF ENERGY DEVELOPMENTS EUROPEAN SATELLITES

Section 15

PRODUCTION OF ENERGY

Unlike the USSR, the European Satellites appear to have no program for the transfer of dependence upon coal as the major source of energy to reliance upon crude oil and natural gas. The apparently limited reserves of crude oil and natural gas in these countries simply do not permit any significant reapportionment from internal sources. (See Table 4-1) As shown in Table 4-2, very little change has occurred in the makeup of production of primary energy in the European Satellites during the period 1950-61. Coal's position has declined slightly as a result of increases in the shares of crude oil and natural gas. In more recent years, however, the relative importance of crude oil as a source of energy has fallen off somewhat, as the Rumanian natural gas industry has moved toward equality, in terms of standard fuel output, with the production of crude oil in that country.

The distribution of production of primary energy for the years 1956 and 1961 among the countries that make up the European Satellites is shown in Table 4-4. Of these countries, Poland provides the major share--32.9 percent in 1961--of total domestic production of primary energy in the European Satellites. East Germany provides the next largest share--26.4 percent, and Czechoslovakia ranks third in accounting for 18.7 percent of the total. Other than for minor revisions, there have been no significant changes in this pattern in the period under study and none are anticipated.

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* Except where noted, all data in this Chapter have been taken from Popov, I.V., Energetika stran narodnoy demokratiy (Energy in the Countries of the Peoples Democracy) Moscow, 1961, and Lisichkin, S.M., Neftyanaya promyshlennost' stran narodnoy demokratiy (The Oil Industry in the Countries of the Peoples Democracy), Moscow, 1960.

TABLE 4-1

RESERVES OF PRIMARY ENERGY
IN EAST EUROPE c/, BY COUNTRY a/

COUNTRY	COAL HARD (MMT) *	COAL BROWN (MMT)	CRUDE OIL (MMT)	NATURAL GAS (MCM) **	PEAT (MMT)	HYDRO-ELECTRIC POWER (MKWH PER YEAR) ***
Albania	0	0	NA	0	0	5,000
Bulgaria	42	3,500	NA	0	0	11,100
Hungary	20	2,520	NA	3,700	0	3,350
East Germany	162	30,455	NA	0	0	2,000
Poland	135,000	33,000	NA	4,000	5,900	13,300
Rumania	48	2,480	80	246,000	68	27,000
Czechoslovakia	6,000	7,300	NA	3,000	0	12,000
TOTAL	141,272	79,255	100 b/	256,700	5,968	73,750

* Million Metric Tons.
** Million Cubic Meters.
*** Million Kilowatt-Hours.
a/ 1/
b/ 2/
c/ Throughout Part IV, "East Europe" is the term used to refer to the satellite countries listed here.

There are only limited possibilities for the expansion of production of energy in any of the European Satellite nations and this condition, coupled with growing requirements for fuels brought about by the rapid expansion of industrial output, has forced these nations, together with the Soviet Union, to work out a program for cooperation in the mutual exchange of fuels and energy.

Map No. 13 illustrates the limited petroleum facilities in East Europe. The production of crude oil in East Europe has increased by only 1.66 million tons or 12.8 percent during 1956-61. Of this increase, 1.094 million tons was provided by Rumania and most of the remainder by Albania. In 1961 Rumania accounted for more than 80 percent of total output of crude oil

TABLE 4-2

PRODUCTION OF PRIMARY ENERGY* IN THE EUROPEAN SATELLITES***
1950, 1956 AND 1959 - 1961 a/

SOURCE OF ENERGY	1950 MILLION METRIC TONS STANDARD FUEL	1950 PERCENT OF TOTAL	1956 MILLION METRIC TONS STANDARD FUEL	1956 PERCENT OF TOTAL	1959 MILLION METRIC TONS STANDARD FUEL	1959 PERCENT OF TOTAL	1960 MILLION METRIC TONS STANDARD FUEL	1960 PERCENT OF TOTAL	1961 MILLION METRIC TONS STANDARD FUEL	1961 PERCENT OF TOTAL
Coal**	148.44	91.9	205.8	86.5	226.2	85.6	238.6	85.5	248.7	85.4
Crude Oil	7.72	4.8	19.2	8.1	20.0	7.6	20.7	7.4	21.4	7.3
Natural Gas	4.59	2.8	10.7	4.5	15.5	5.9	16.8	6.0	17.8	6.1
Hydroelectric Power	0.80	0.5	2.1	0.9	2.4	0.9	2.9	1.1	3.4	1.2
TOTAL b/	161.55	100.0	237.8	100.0	264.1	100.0	279.0	100.0	291.3	100.0

* Excluding peat and fuel wood.
** Including hard coal, brown coal and lignite.
*** Conversion factors used throughout the report to convert production in natural units in the European satellite countries to units of standard fuel are given in Table 4-3.
a/ Excluding Albania. After 3/.
b/ Totals may not compare with the sum of the components of the individual countries because of rounding.

MAP NO.
PETROLEUM FACILITIES OF EAST EUROPE
March 1962
COMECON PIPELINE
Completed
Under Construction
Possible Branch Line
CRUDE OIL PIPELINES
In Use
Planned
PETROLEUM PRODUCT PIPELINES
In Use
Planned
NATURAL GAS PIPELINE
In Use
Planned
MANUFACTURED GAS PIPELINE
CRUDE OIL/NATURAL GAS PIPELINE
REFINERY
SCALE
Miles
Kilometers
Boundaries are not necessarily those recognized by the U.S. Government.
BALTIC SEA
ADRIATIC SEA
AEGEAN SEA
BLACK SEA
SEA OF MARMARA
STRAIT OF OTRANTO
POLAND
East Germany
GERMANY
CZECHOSLOVAKIA
AUSTRIA
HUNGARY
RUMANIA
YUGOSLAVIA
BULGARIA
ALBANIA
GREECE
TURKEY
ITALY
U. S. S. R.
WARSAW
BERLIN
PRAGUE
VIENNA
BUDAPEST
BUCHAREST
BELGRADE
SOFIA
TIRANË
Gdańsk
Gdynia
Szczecin
Schwedt
Płock
Łódź
Kraków
Poznań
Wrocław
Leipzig
Dresden
Halle
Leuna
Zeitz
Brno
Bratislava
Ostrava
Košice
Užgorod
Komárno
Százhalombatta
Szeged
Debrecen
Cluj
Brazi
Ploești
Cîmpina
Onești
Burgas
Ruse
Dashava
Brest
Mozyr
To Unecha
Trieste
Zagreb
Rijeka
Cerrik
Fier
Vlonë
Kaliningrad
Minsk
Pinsk


MAP NO. 13
BALTIC SEA
P O L A N D
U. S. S. R.
C Z E C H O S L O V A K I A
H U N G A R Y
R U M A N I A
Y U G O S L A V I A
B U L G A R I A
ALBANIA
G R E E C E
T U R K E Y
BLACK SEA
SEA OF MARMARA
AEGEAN SEA
STRAIT OF OTRANTO
WARSAW
PRAGUE
VIENNA
BUDAPEST
BUCHAREST
BELGRADE
SOFIA
TIRANË
Kaliningrad
Gdańsk
Gdynia
Szczecin
Poznań
Płock
Włocławek
Łódź
Radom
Kielce
Częstochowa
Kraków
Tarnów
Rzeszów
Jasło
Przemyśl
Brest
Pinsk
Mozyr
To Unecha
Brody
Dashava
Stryy
L'vov
Kiev
Minsk
Bratislava
Nitra
Košice
Uzhgorod
Chop
Ostrava
Olomouc
Brno
Žilina
Miskolc
Szolnok
Százhalombatta
Dunaújváros
Cluj
Mediaş
Ploeşti
Oneşti
Braşov
Cîmpina
Constanţa
Giurgiu
Ruse
Burgas
Varna
Cerrik
Kuçove
Fier
Vlonë
Durrës
Elbasan
EAST EUROPE
150 Miles
150 Kilometers
the U.S. Government.

in East Europe. Any shift away from Rumania as the dominant crude oil producer is unlikely.

TABLE 4-3

ENERGY CONVERSION FACTORS
FOR THE EUROPEAN SATELLITES

COUNTRY	HARD COAL a/	BROWN COAL AND LIGNITE a/	CRUDE OIL a/	NATURAL GAS b/	HYDRO-ELECTRIC POWER c/
Albania	-	0.5000	1.40	1.30	0.5
Bulgaria	0.7500	0.4966	1.40	1.30	0.5
Czechoslovakia	0.7271	0.4989	1.50	1.30	0.5
East Germany	0.8571	0.3143	1.50	1.30	0.5
Hungary	0.6714	0.4643	1.40	1.30	0.5
Poland	0.8571	0.2857	1.50	1.30	0.5
Rumania	0.5714	0.2771	1.50	1.35	0.5

a/ The given factor times production expressed in millions of tons yields millions of tons of standard fuel.
b/ The given factor times production expressed in millions of cubic meters yeilds thousands of tons of standard fuel.
c/ The given factor times production expressed in billions of kilowatt-hours yields millions of tons of standard fuel.

The total production of crude oil in East Europe currently is the equivalent of less than 9 percent of the annual output in the USSR. This share will continue to decline, to perhaps as little as 6 percent by 1965. The production of crude oil in East Europe, by country, for the years 1955-56 and 1959-61 is given in Table 4-5.

The production of natural gas in East Europe, of which about 80 percent originates in Rumania, is equal to about 23 percent of the USSR production of natural gas, but this relationship will be drastically reduced by 1965, as the USSR continues to rapidly expand its production of natural gas, whereas East Europe lacks an adequate resource base for any significant increase in output. The production of natural gas in East Europe, by country, for 1955-56 and 1959-61 is given in Table 4-6.

TABLE 4-4

DISTRIBUTION OF PRODUCTION OF PRIMARY ENERGY IN THE EUROPEAN SATELLITES, BY COUNTRY a/
1956 AND 1961

COUNTRY	1956 MILLION METRIC TONS OF STANDARD FUEL	1956 PERCENT OF TOTAL	1961 MILLION METRIC TONS OF STANDARD FUEL	1961 PERCENT OF TOTAL
Albania	0.5	0.2	1.4	0.5
Bulgaria	6.2	2.6	10.5	3.6
Czechoslovakia	38.4	16.2	54.5	18.7
East Germany	67.4	28.4	76.8	26.4
Hungary	12.4	5.2	16.3	5.6
Poland	84.5	35.5	95.9	32.9
Rumania	28.4	11.9	35.9	12.3
TOTAL b/	237.7	100.0	291.2	100.0

a/ Data derived from Tables 4-5 through 4-8.
b/ Totals do not agree with the sum of the components because of rounding.

Data on the production of hard coal, brown coal and lignite in East Europe, by country, for the years 1956, and 1959-61 is given in Table 4-7. These data indicate that the total production of all types of coal in East Europe approximates the total output of coal in the Soviet Union and very likely will exceed the USSR output level in 1962, if the trend in the absolute growth in production can be maintained.

Other than coal, hydroelectric power is the only primary energy source in East Europe which has not only maintained its relative position to output in the Soviet Union, but in the last two years has shown a slight gain. In 1961, the generation of hydroelectric power in East Europe reached an estimated 6.7 billion kilowatt-hours, which represented about 11.8 percent of the Soviet output level. The output of hydroelectric power in East Europe, by country, for 1956 and 1959-61 is given in Table 4-8.

TABLE 4-5

PRODUCTION OF CRUDE OIL IN THE EUROPEAN SATELLITES
1955-61 AND 1965 ESTIMATE
(Thousand Metric Tons)

COUNTRY	1955 a/	1956 b/	1957 b/	1958 b/	1959 b/	1960 b/	1961	1965*
Albania	210	266	490	400	479	700 c/	800 d/	1,100
Bulgaria	150	247	285	200	192	200	220 e/	300
Czechoslovakia	110*	108	108	106	123	137	150*	200
East Germany	Negl.	Negl.	0	0	2	2*	6*	1,000 i/
Hungary	1,600	1,202	700	800	1,036	1,215	1,440 f/	1,750
Poland	180	184	181	175	175	194	200 g/	300
Rumania	10,556	10,920	11,180	11,336	11,438	11,500	11,650 h/	12,500 i/
TOTAL	12,806	12,927	12,944	13,017	13,445	13,948	14,466	17,150

* Committee estimate.
a/ 4/
b/ Except where noted, data have been derived from the statistical handbooks issued by the individual countries of the European Satellites. Data on Bulgaria have been taken from various issues of the Statistical News, a quarterly publication in Bulgarian.
c/ 5/
d/ 6/
e/ 7/
f/ 8/
g/ 9/
h/ 10/
i/ Plan.

TABLE 4-6

PRODUCTION OF NATURAL GAS IN THE EUROPEAN SATELLITES - 1955-56 AND 1959-61 (Million Cubic Meters)

COUNTRY	1955 a/	1956 b/	1959 b/	1960 b/	1961
Albania	0	0	0	0	0
Bulgaria	0	0	0	0	0
Czechoslovakia	173 c/	274	1,482	1,439	1,500*
East Germany	20*	20	23	40*	40*
Hungary	543	452	334	340	320 d/
Poland	349	435	424	549	700 e/
Rumania	6,171	6,756	9,305	10,142	10,700 f/
TOTAL	7,256	7,937	11,568	12,510	13,260

* Committee estimate.
a/ Except where noted, from 11/.
b/ Except where noted, data have been derived from the statistical handbooks issued annually by the individual countries of the European Satellites.
c/ 12/
d/ 13/
e/ 14/
f/ 15/

TABLE 4-7

PRODUCTION OF COAL IN THE EUROPEAN SATELLITES, BY TYPE AND BY COUNTRY a/
1956 AND 1959 - 1961
(Thousand Metric Tons)

	ALBANIA	BULGARIA	CZECHO-SLOVAKIA	EAST GERMANY	HUNGARY	POLAND	RUMANIA	TOTAL
1956 a/								
Hard Coal	0	370	21,788	2,743	2,371	95,149	3,458	125,879
Brown Coal and Lignite	224	10,447	42,299	205,866	18,219	6,183	3,014	286,252
TOTAL	224	10,817	64,087	208,609	20,590	101,332	6,472	412,131
1959 a/								
Hard Coal	0	503	25,125	2,841	2,734	99,106	4,129	134,438
Brown Coal and Lignite	288	14,857	53,703	214,783	22,613	9,258	3,848	319,350
TOTAL	288	15,360	78,828	217,624	25,347	108,364	7,977	453,788
1960 a/								
Hard Coal	0	570	26,214	2,721	2,847	104,438	4,481	141,271
Brown Coal and Lignite	291 b/	16,555	57,888	225,465	23,676	9,327	3,682	336,884
TOTAL	291	17,125	84,102	228,186	26,523	113,765	8,163	478,155
1961								
Hard Coal	0	650 *	26,000 *	2,650 c/	3,000 d/	106,600 e/	4,700 f/	143,600
Brown Coal and Lignite	300 *	18,400 g/	63,700 *	236,000 c/	25,400 d/	10,200 h/	4,000 f/	358,000
TOTAL	300	19,050	89,700	238,650	28,400	116,800	8,700	501,600

* Estimate.

a/ The data presented in the table for the years 1956 and 1959-60 have been derived from the various issues of the statistical handbooks which are published annually on the individual countries of the European Satellites. Data on Bulgaria has been taken from various issues of the Statistical News, a quarterly publication in Bulgarian.

b/ 16/
c/ 17/
d/ 18/
e/ 19/
f/ 20/
g/ 21/
h/ 22/

TABLE 4-8

PRODUCTION OF HYDROELECTRIC POWER IN THE EUROPEAN SATELLITES - 1956 AND 1959-61
(Million Kilowatt-Hours)

COUNTRY	1956 a/	1959 a/	1960 a/	1961 b/
Albania	60	100	116	125
Bulgaria	754	1,104	1,400	1,680
Czechoslovakia	1,899	2,063	2,495	3,000
East Germany	522	536	617	630
Hungary	35	79	91	105
Poland	637	551	657	725
Rumania	287	298	397	465
TOTAL	4,194	4,731	5,773	6,730

a/ Data have been derived from the statistical handbooks issued by the individual countries of the European Satellites. Data on Bulgaria have been taken from various issues of the Statistical News, a quarterly publication in Bulgarian.

b/ Committee estimate.

SECTION 16

CONSUMPTION AND TRADE

A. General

Because the consumption of energy in the European Satellites is increasing more rapidly than is production, it is probable that in the very near future the European Satellites will become an energy-deficient region. Table 4-9 shows that net exports of all forms of energy declined from 20.6 million tons of standard fuel in 1950 to 6.4 million in 1960. Table 4-10 summarizes East European energy consumption for 1950, 1955 and 1960.

TABLE 4-9

NET TRADE IN PRIMARY ENERGY IN EAST EUROPE a/
1950, 1955 AND 1960
(Million Metric Tons of Standard Fuel)

	1950	1955	1960
Coal	+17.22	+11.12	+3.90
Lignite	+ 1.62	+ 4.12	+4.90
Liquid Fuel	+ 1.84	+ 3.82	-2.00
Natural Gas	- 0.08	- 0.17	-0.40
TOTAL	+20.60	+18.89	+6.40

a/ Data derived from Tables 4-5 through 4-7 and Table 4-10. Net exports designated by a plus (+) sign, net imports by a minus (-) sign.

Taking cognizance of this coming deficiency, a fuels-production program had been laid out, wherein each country will concentrate on the production of that source of energy determined to be the most economically expedient regardless of local consumption patterns. Thus, under this plan, the USSR will make available crude oil and petroleum products as will Rumania; Poland will continue to export coal, with growing significance given to the export of brown coals; Czechoslovakia will export coking coal and import fuel coals; primarily from Poland; the USSR will continue to export coal, but emphasis will be shifted from the export of fuel coal to the export of coking coal. Minor amounts of natural gas will be moved from Rumania to Hungary (200 million cubic meters per year) and from the USSR to Poland (200 million cubic meters per year at present). The result of this cooperative effort will be to maximize the energy producing potential of the group, although not one of the satellite nations will meet all of its energy needs from its own sources.

TABLE 4-10

CONSUMPTION OF PRIMARY ENERGY IN EAST EUROPE a/ 1950, 1955 AND 1960

SOURCE OF ENERGY	1950 MMTSF*	1950 PERCENT OF TOTAL	1955 MMTSF*	1955 PERCENT OF TOTAL	1960 MMTSF*	1960 PERCENT OF TOTAL
Hard and Brown Coal	65.830	46.7	89.577	43.8	111.36	40.9
Lignite	63.770	45.2	91.700	44.9	118.32	43.4
TOTAL COAL	129.600	91.9	181.277	88.7	229.68	84.3
Liquid Fuel	5.880	4.2	12.550	6.1	22.70	8.3
Natural Gas	4.670	3.3	8.960	4.4	17.20	6.3
Hydro-electric Power	0.800	0.6	1.620	0.8	2.90	1.1
TOTAL	140.950	100.0	204.407	100.0	272.48	100.0

* MMTSF = Million Metric Tons of Standard Fuel.

a/ After 1/ but with adjustments in conversion factors and substitution of later data for 1960, where appropriate.

B. Petroleum

Of particular interest is the growing dependence of East Europe upon the USSR as a supplier of liquid fuel, in the form of crude oil. Under provisions established by Comecon or CEMA (The Council for Mutual Economic Assistance), East Europe is now undertaking a program of expansion of its crude oil refining facilities. This expansion is concomitant with an anticipated growth in the domestic demand for petroleum products. The growth in domestic demand will far exceed any increases in the indigenous production of crude oil. To cover the growing gap between production and demand, East Europe plans to step up its imports of crude oil from the Soviet Union. Such imports already have increased from 2.9 million tons in 1956 to 9.1 million tons in 1960. Analysis of contracts for purchases of crude oil alone in 1965 indicate that East Europe will import 17.4 million tons of crude oil in that year from the Soviet Union. Of this quantity, a reported 15 million tons will be delivered through the Comecon crude oil pipeline or the so-called "Pipeline of Friendship." The scheduled delivery of crude oil from the Soviet Union to East Europe, according to country of destination, is given in Table 4-11. An additional 2 to 3 million tons of petroleum products may be imported from the USSR.

TABLE 4-11

SCHEDULED DELIVERIES OF CRUDE OIL BY THE SOVIET UNION TO THE COUNTRIES OF EAST EUROPE - 1965

COUNTRY	AMOUNT (THOUSAND METRIC TONS)
Albania	-
Bulgaria	1,000 a/
Czechoslovakia	6,000 b/
East Germany	4,800 c/
Hungary	2,500 d/
Poland	3,100 e/
Rumania	-
TOTAL	17,400

a/ 2/
b/ 3/
c/ 4/
d/ Based on pipeline capacity.
e/ 5/

The decision taken by CEMA to allow East Europe to expand its refining facilities, rather than to increase the imports of petroleum products from the Soviet Union, may be primarily economic in nature. Expansion of East Europe's refining facilities together with the installation of large diameter crude oil pipe lines undoubtedly will give the Bloc cheaper petroleum than if the Soviet Union were the source for petroleum products. In addition, the establishment of an adequate refining industry will permit the development of a petrochemical industry in East Europe. Finally, the Soviet Union may not have wished to force the expansion of its own refining industry beyond that level considered adequate for internal needs just in order to accommodate growing requirements in East Europe.

The refinery plans and crude import patterns are apparently arranged so that by 1965, each of the satellites will be close to self-sufficiency from the standpoint of refining capacity. Rumania will have an excess of crude oil and refining capacity, and may be in a position to export some products to the USSR and to the Free World, while East Germany may continue to export some products to the Free World. Intra-bloc movement of products, however, will be minimized.

C. Other Energy

Of particular importance is the problem of inter-nation exchange of electric power. In 1957, a total of 611 million kilowatt-hours of electric power was transferred within the European satellite countries. About one-half of this total originated with East Germany. At present, the planning authorities have emphasized the need for each of these countries to develop their own source of electric power, and only as a means of additional supply to rely upon the import of electric power from a neighboring country. Certain of the European Satellite nations--Hungary, Czechoslovakia, East Germany and Bulgaria--are either presently lacking energy resources for the generation of electric power or are approaching that position. The Soviet participation in the supplying of electric power to the European Satellites will of necessity be rather limited. This power would have to originate in the western part of the USSR, where fuels for the thermal power stations are in limited supply.

One factor which limits the exchange of electric power between the satellite countries is the inadequate carrying capacity of the power transmission systems. As the first stage in the uniting of the electric power systems of East Germany, Poland, Czechoslovakia, and Hungary; Rumania and Czechoslovakia; Hungary, Poland and the Western Ukraine and Kaliningrad systems of the USSR, --electric power lines with rating of 220 kilovolts and higher will be built. After 1965 and through 1970, further development of the system will call for 380 kilovolt lines.

A basic problem confronting East Europe is the lack of coking coals. The USSR, Poland and Czechoslovakia will continue to supply coke and coking coals to East Germany, Hungary, Rumania and Bulgaria. However, Czechoslovakia is lacking in hard energy coals and Poland in certain types of coking coals. To cover these deficits, Poland will export hard energy coals to Czechoslovakia and the USSR will export to Poland those types of coking coals in short supply.

SECTION 17

PETROLEUM BALANCE IN EAST EUROPE

A scarcity of published data makes it difficult to obtain accurate numbers for the petroleum demand of individual countries in East Europe. However, the pattern can be drawn fairly accurately for the East European group as a whole. Crude oil production figures are usually made available for each country. Additional supplies to East Europe are imported entirely from the USSR and official figures for Soviet exports to East Europe are published annually. Exports from East Europe to the Soviet Union are available in official Soviet statistics, and exports to the Free World can be estimated with reasonable accuracy from sources available in the importing countries. Table 4-12 constructs a petroleum supply-demand balance for the European Satellites for the years 1956 through 1960, together with estimates for 1961 and 1965.

This balance illustrates the previously mentioned point of the increased dependence of East Europe on Soviet petroleum supplies. Crude oil production in East Europe increased from 12.9 million tons in 1956 to 13.9 million tons in 1960, for an average annual increase of less than 2 percent. Intensive efforts to find more oil in some of the satellite countries may bring East European production to 17.2 million tons by 1965, which would be an increase of 4 percent per year for the period 1961-65. Demand, however, is growing much more rapidly. In 1956, indigenous production plus the manufacture of synthetic oils permitted net exports of small quantities of liquid products from the satellite countries. However, apparent demand has grown at a rate of 9 percent per year between 1956 and 1960. Although in 1960 the equivalent of one-half (9.1 million tons) of East European local demand was supplied by the USSR, during the year those countries are reported to have exported to the USSR and the Free World a total of 7 million tons. It is estimated that demand in 1965 will be 30 to 31 million tons, representing an annual growth rate of 11 percent during 1961-65. Because crude oil production will increase less rapidly than demand during these years, most of the growth in demand must be met by increased deliveries from the USSR. Such deliveries from the USSR may increase by about 17 percent per year through 1965. Thus in 1965 the USSR may supply about 20 million tons or two-thirds of the petroleum demand in East Europe. The major part of the Soviet exports (17-18 million tons) will be in the form of crude oil.

Despite the shortage of indigenous petroleum, the European Satellites have been gradually increasing exports of petroleum products to the Free World. In 1960 total Free World imports from East Europe reached about 3.6 million tons and increased by 25 percent to about 4.5 million tons in 1961. Most of these imports originated with Rumania, which is the only East European country with appreciable crude oil production in excess of domestic needs. Lesser amounts were obtained from East Germany, which is making increasing sales of products (largely synthetic) to West Germany. Current activity in sales effort on the part of the European Satellite nations indicates that exports from the satellites to the Free World will continue to grow for the next several years and may reach as much as 5 million tons in 1965.

TABLE 4-12

PETROLEUM SUPPLY AND DEMAND BALANCE
IN EAST EUROPE a/
1956-60 AND ESTIMATES FOR 1961 AND 1965
(Million Metric Tons)

						COMMITTEE ESTIMATE	
SUPPLY	1956	1957	1958	1959	1960	1961	1965
Production of Crude Oil	12.9	12.9	13.0	13.4	13.9	14.4	17.2
Production of Natural Gas Liquids and Synthetics	2.4	2.4	2.4	2.4	2.4	2.4	1.4
Imports of Crude Oil and Petroleum Products b/	2.9	5.2	5.7	7.3	9.1	10.5	20.2
TOTAL SUPPLY	18.2	20.5	21.1	23.1	25.4	27.3	38.8
DEMAND							
Exports of Crude Oil and Petroleum Products -							
To USSR	3.9	3.2	3.4	3.4	3.4	3.4	3.0
To Free World	1.8	1.9	2.2	3.1	3.6	4.5	5.0
TOTAL EXPORTS	5.7	5.1	5.6	6.5	7.0	7.9	8.0
Apparent Demand c/	12.5	15.4	15.5	16.6	18.4	19.4	30.8
TOTAL DEMAND	18.2	20.5	21.1	23.1	25.4	27.3	38.8

a/ For derivation, see the Supply-Demand Tables for the individual East European countries.
b/ All from the Soviet Union.
c/ Includes losses and consumption in processing.

CHAPTER V

ENERGY IN ALBANIA

CHAPTER V *

ENERGY IN ALBANIA

SECTION 18

SUMMARY

Based on current estimates of energy availability, the major sources of energy in Albania are considered to be crude oil, brown coal and lignite, the general locations of which are shown on Map No. 14. Albania has no production of hard coal. Table 5-1 summarizes available information on primary energy production in Albania for the years 1956 and 1959-61.

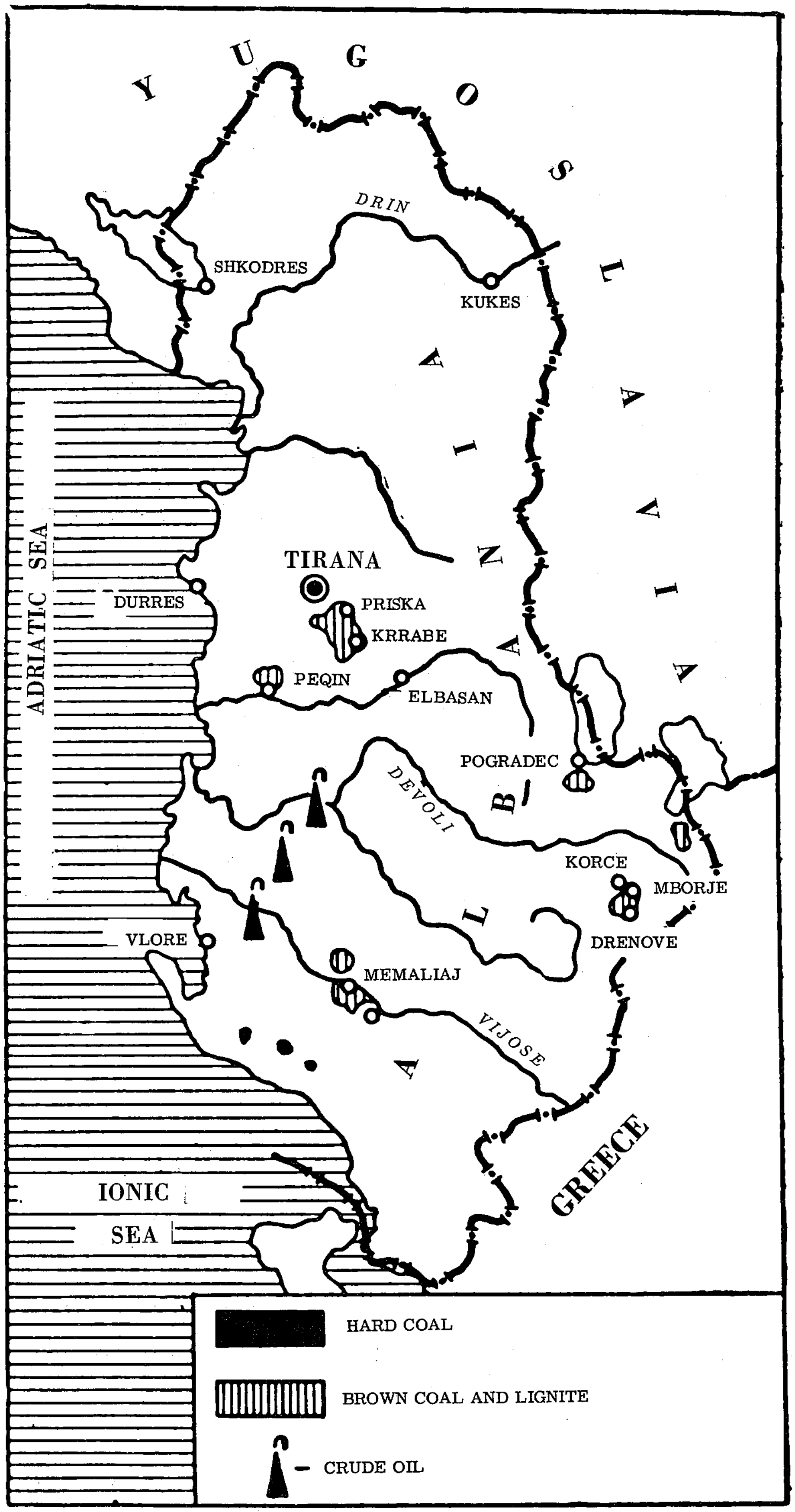
The reserves and production of crude oil not only are sufficient to meet the internal needs of the economy, but allow for significant export to other countries, as shown in the following tabulation, which depicts estimated petroleum balances for Albania for 1960 and 1965:

ESTIMATED CRUDE AND PRODUCTS SUPPLY AND DEMAND IN ALBANIA 1960 AND 1965

	THOUSAND METRIC TONS	
SUPPLY	1960	1965
Production of Crude Oil	700	1,100
Imports of Crude Oil and Petroleum Products from USSR	6	0
TOTAL SUPPLY	706	1,100
DEMAND		
Exports of Crude Oil and Petroleum Products - To USSR	312	250
To Free World	0	200
Apparent Domestic Demand	394	650
TOTAL DEMAND	706	1,100

* Except where noted, all data in this Chapter have been taken from Popov, I.V., Energetika stran narodnoy demokratiy (Energy in the Countries of the Peoples Democracy) Moscow, 1961, and Lisichkin, S.M., Neftyanaya promyshlennost' stran narodnoy demokratiy (The Oil Industry in the Countries of the Peoples Democracy), Moscow, 1960.

MAP NO. 14



DISTRIBUTION OF FUELS-ENERGY RESOURCES OF ALBANIA

TABLE 5-1

PRODUCTION OF PRIMARY ENERGY IN ALBANIA
1956 AND 1959-1961
(Million Metric Tons of Standard Fuel)

SOURCE OF ENERGY	1956		1959		1960		1961	
	AMOUNT	PERCENT OF TOTAL	AMOUNT	PERCENT OF TOTAL	AMOUNT	PERCENT OF TOTAL	AMOUNT	PERCENT OF TOTAL
Coal	0.1	20.0	0.1	11.1	0.1	8.3	0.2	14.3
Crude Oil	0.4	80.0	0.7	77.8	1.0	83.4	1.1	78.6
Natural Gas	0	0	0	0	0	0	0	0
Hydroelectric Power	Negl.	Negl.	0.1	11.1	0.1	8.3	0.1	7.1
TOTAL	0.5	100.0	0.9	100.0	1.2	100.0	1.4	100.0

SECTION 19

PETROLEUM IN ALBANIA

A. Production and Consumption

In 1939, the Patos deposit was placed in commercial use, and at present is reported to provide more than 80 percent of the total national output. Exploitation had begun several years earlier at the Kucove deposit. In 1957 the Marize deposit was discovered and this deposit, although not fully developed as yet, will provide for further increases in the national output.

Albania oil production for selected years 1950-61 is given in the following table.

TABLE 5-2

PRODUCTION OF CRUDE OIL IN ALBANIA
SELECTED YEARS 1950-1961

YEAR	THOUSAND METRIC TONS
1950	130
1953	150
1954	180
1955	210
1956	266
1957	490
1958	400
1959	479
1960	700
1961	800

An estimated supply-demand balance for Albania for the years 1956-61 and 1965 is given in Table 5-3.

Recently, Albania has been a net exporter of petroleum. These exports are largely crude and asphalt to the USSR. In 1960, for example, exports to the USSR were reported to be about 164 thousand tons of crude oil and 148 thousand tons of asphalt. Total exports amount to about one-half of production.

TABLE 5-3

ESTIMATED PETROLEUM SUPPLY AND DEMAND
IN ALBANIA - 1956-61 AND 1965
(Thousand Metric Tons)

						Committee Estimate	
SUPPLY	1956	1957	1958	1959	1960	1961	1965
Production of Crude Oil a/	266	490	400	479	700	800	1,100
Imports of Crude Oil and Petroleum Products from USSR b/	10	5	5	9	6	5	0
TOTAL SUPPLY	276	495	405	488	706	805	1,100
DEMAND							
Exports - To USSR b/	198	319	171	198	312	350	250
To Free World c/	0	0	0	0	0	0	200
TOTAL	198	319	171	198	312	350	450
Apparent Domestic Demand d/	78	176	234	290	394	455	650
TOTAL DEMAND	276	495	405	488	706	805	1,100

a/ Derived from Table 4-5.
b/ 1/
c/ Committee Estimate.
d/ Includes losses and consumption in processing.

B. Refining of Petroleum

Only two crude oil refineries are reported in operation in Albania. One refinery is located at Kucove and has a charge capacity of 150,000 tons. The second, located at Cerrik, is currently undergoing a program of expansion. It is reported that the charge capacity is to be doubled, from 150,000 tons to 300,000 tons. It is estimated that the present capacity is on the order of 250,000 tons.

At these refineries, emphasis is placed on a maximum yield of residual fuel oil and asphalt. Almost two-thirds of the product output in Albania in 1960 was in the category of "residuals and others", as illustrated by the following table.

TABLE 5-4

OUTPUT OF REFINED PRODUCTS IN ALBANIA
1955 AND 1958-1960
(Thousand Metric Tons)

PRODUCT	1955	1958	1959	1960 c/
Gasoline	4 a/	31 a/	48 b/	40
Tractor Kerosine	3 a/	3 a/	3 b/	10
Diesel Fuel	6 a/	50 a/	63 b/	68
Lubricants	1 d/	6 d/	7 d/	7
Residuals and others	50 d/	183 d/	185 d/	200
TOTAL	64	273	306	325

a/ 2/
b/ 3/
c/ 4/
d/ 5/

SECTION 20

OTHER ENERGY IN ALBANIA

The major deposits of coal in Albania are those at Memaliaj, Mborje-Drenova, Krroba and Priska. So far as can be determined, any further increases in annual production will be provided by these deposits. Albanian coal is of relatively poor quality, characterized by a low heat value, and is used chiefly by thermal electric power stations and for communal needs.

TABLE 5-5

PRODUCTION OF COAL IN ALBANIA
SELECTED YEARS 1950-1961

YEAR	THOUSAND METRIC TONS
1950	10
1956	224
1959	288
1960	291
1961 (Est.)	300

Although the output of electric power in Albania is reported to have increased by more than 10 times in the past ten years, the per capita consumption of electric power still is quite small. Future planned increases in output are to be based chiefly on the construction of new hydroelectric power stations which, if accomplished, will preserve hydrostations as the leading source of power generation in Albania. One such station was built during 1951-1955--capacity of 5-megawatts, and a second during 1956-1960--capacity of 20-megawatts. Two more plants are planned for 1961-1965, one a 27-megawatt plant and the other 20-megawatt.

In addition, it is reported that in the next several years a series of thermal power plants is to be constructed. These plants will have a total capacity approaching 6-megawatts. Prior to 1956, each of the electric power stations in Albania operated independently, but since that time, most of the major stations have been included in a national grid system designed to supply electric power to the major industrial and agricultural centers.

The relationship of electric power output from hydrostations to total electric power output in Albania for selected years 1950-61 is shown by the table below.

TABLE 5-6

GENERATION OF ELECTRIC POWER IN ALBANIA
SELECTED YEARS 1950-1961
(Million Kilowatt-hours)

YEAR	TOTAL	OF WHICH, FROM HYDROSTATIONS AMOUNT	PERCENT OF TOTAL
1950	20	NA	NA
1953	50	NA	NA
1954	60	NA	NA
1955	90	NA	NA
1956	104	60	57.7
1957	120	NA	NA
1958	150	NA	NA
1959	175	100	57.1
1960	194	116	59.8
1961	206	125	60.7

CHAPTER VI

ENERGY IN BULGARIA

CHAPTER VI*

ENERGY IN BULGARIA

SECTION 21

SUMMARY

Energy production in Bulgaria for 1956 and 1959-61 is summarized in Table 6-1. The major source of energy is brown coal and lignite and the geographic extent of these deposits is shown on Map No. 15. Together, all types of coal provide almost 90 percent of the indigenous production of primary energy. Little change has occurred in the energy production balance in the last 5 years, with the exception of a decline in the crude oil share. Production of crude oil has remained constant at about 0.3 million tons of standard fuel (4,000 barrels per day), thus about 80 percent of Bulgarian petroleum requirements are met by imports, primarily from the USSR. Estimated petroleum balances for Bulgaria for 1960 and 1965 are as follows:

ESTIMATED CRUDE OIL AND PRODUCTS
SUPPLY AND DEMAND IN BULGARIA
1960 AND 1965

	THOUSAND METRIC TONS	
SUPPLY	1960	1965
Production of Crude Oil	200	300
Imports of Crude Oil and Petroleum Products - From USSR	821)	
From Other Bloc Countries	150)	1,500
TOTAL SUPPLY	1,171	1,800
DEMAND		
Exports of Crude Oil and Petroleum Products to Other Bloc Countries	21	0
Apparent Domestic Demand	1,150	1,800
TOTAL DEMAND	1,171	1,800

* Except where noted, all data in this Chapter have been taken from Popov, I.V., Energetika stran narodnoy demokratiy (Energy in the Countries of the Peoples Democracy) Moscow, 1961, and Lisichkin, S.M., Neftyanaya promyshlennost' stran narodnoy demokratiy (The Oil Industry in the Countries of the Peoples Democracy), Moscow, 1960.

TABLE 6-1

PRODUCTION OF PRIMARY ENERGY IN BULGARIA
1956 AND 1959-1961
(Million Metric Tons of Standard Fuel)

SOURCE OF ENERGY	1956		1959		1960		1961	
	AMOUNT	PERCENT OF TOTAL	AMOUNT	PERCENT OF TOTAL	AMOUNT	PERCENT OF TOTAL	AMOUNT	PERCENT OF TOTAL
Coal	5.5	88.7	7.8	89.7	8.6	89.6	9.4	89.5
Crude Oil	0.3	4.8	0.3	3.4	0.3	3.1	0.3	2.9
Natural Gas	0	0	0	0	0	0	0	0
Hydroelectric Power	0.4	6.5	0.6	6.9	0.7	7.3	0.8	7.6
TOTAL	6.2	100.0	8.7	100.0	9.6	100.0	10.5	100.0

MAP NO. 15

DISTRIBUTION OF FUELS-ENERGY RESOURCES OF BULGARIA

SECTION 22

PETROLEUM IN BULGARIA

A. Production and Consumption

All of the production of crude oil in Bulgaria is provided by the Tyulenevo deposit, discovered in 1951. The commercial production from this field began in 1954. Bulgarian crude is a very heavy crude; and because of insufficient refinery facilities at present, a relatively large portion of this crude oil has been exported.

Domestic demand is supplied largely by imports, most of which are in the form of finished products from the USSR. With the completion of new refining capacity, future imports will have increasing proportions of crude oil. Table 6-2 shows an approximate supply-demand balance for petroleum from 1956 through 1961, plus estimates for 1965.

B. Refining of Petroleum

At present, Bulgaria has one small refinery, located at Ruse. This refinery produces small quantities of diesel fuel and residual fuel oil. This refinery is under expansion and in the future will concentrate on the refining of crude to maximize the output of low-freezing industrial lubricants. It is reported that the charge capacity at Ruse is to be 250,000 tons by the end of 1962. A new refinery is under construction at Burgas. The first stage is slated for completion by 1963 and will have a charge capacity of 1 million tons. Construction of these refineries is considered necessary if most of the manufacture of petroleum products is to be met internally. As shown in Table 6-3, which presents the yield of refined products in Bulgaria in 1955 and 1958-1960, plus that estimated for 1965, domestic refining in 1965 will be adequate. Gasoline and kerosine yields apparently are included in other product categories.

TABLE 6-2

ESTIMATED PETROLEUM SUPPLY AND DEMAND IN BULGARIA
1956-60 AND 1961 AND 1965
(Thousand Metric Tons)

						COMMITTEE ESTIMATE	
SUPPLY	1956	1957	1958	1959	1960	1961	1965
Production of Crude Oil a/	247	285	200	192	200	220	300
Imports of Crude Oil and Petroleum Products -							
From USSR b/	165	381	423	559	821	1,000	1,500
From Other Bloc Countries	297 c/	203 c/	250 d/	250 d/	150 d/	0	0
TOTAL IMPORTS	462	584	673	809	971	1,000	1,500
TOTAL SUPPLY	709	869	873	1,001	1,171	1,220	1,800
DEMAND							
Exports to Other Bloc Countries	160	109	94	50	21	0	0
Apparent Domestic Demand e/ f/ g/	549	760	779	951	1,150	1,220	1,800
TOTAL DEMAND	709	869	873	1,001	1,171	1,220	1,800

a/ Derived from Table 4-5.
b/ 1/
c/ 2/
d/ Committee estimate.
e/ 3/
f/ 4/
g/ Includes losses and consumption in processing.

TABLE 6-3

YIELD OF REFINED PRODUCTS IN BULGARIA
1955, 1958-1960 AND 1965 ESTIMATE
(Thousand Metric Tons)

TYPE OF PRODUCT	1955 a/	1958	1959	1960	ESTIMATE 1965 b/
Gasoline	0	Negl.	Negl.	Negl.	270
Kerosine	0	Negl.	Negl.	Negl.	60
Diesel Fuel	5	16 c/	20 c/	25 d/	500
Lubricants	8	21 c/	24 c/	25 d/	50
Residuals and Others	16	42 e/	55 f/	65 f/	970
TOTAL	29	79	99	115	1,850

a/ 5/
b/ 6/
c/ Committee estimate.
d/ Committee estimate based on data for the first half of 1960.
e/ 7/
f/ 8/

SECTION 23

OTHER ENERGY IN BULGARIA

A. Coal

Reports indicate that increases in the production of coal in Bulgaria in recent years have been primarily in brown coal output, and to a slightly lesser degree, in lignite. Based on estimates of reserves and on an examination of the relative costs of production, future increases in the production of coal will be based upon lignite. Reserves and historical production are given in Table 6-4 and 6-5.

TABLE 6-4

PROVED AND PROBABLE RESERVES OF COAL IN BULGARIA - JANUARY 1, 1960

TYPE OF COAL	PROVED AND PROBABLE RESERVES (MILLION METRIC TONS)	PERCENT OF TOTAL
Lignite	3,927.0	92.2
Brown	286.8	6.7
Hard	40.0	0.9
Anthracite	6.9	0.2
TOTAL	4,260.7	100.0

TABLE 6-5

PRODUCTION OF COAL IN BULGARIA 1952 AND 1956-1960 (Thousand Metric Tons)

TYPE OF COAL	1952	1956	1957	1958	1959	1960	1961
Brown	5,307)		8,457	8,704	10,365)	)	
Lignite	1,866)	10,447	3,034	3,646	4,492)	16,555)	18,400
Hard	127)		337	264	353)	)	
Anthracite	110)	370	148	116	150)	570)	650
TOTAL	7,410	10,817	11,976	12,730	15,360	17,125	19,050

In 1959, the average cost of production of coal in Bulgaria was reported at 67.57 lei per ton (about $11.26 per ton at the current official exchange rate). However, a wide range of cost of production according to type of coal, existed. Table 6-6 illustrates the comparative costs of production, and also points up the rationale for giving primary importance to the production of lignite in the coming years.

TABLE 6-6

COST OF PRODUCTION OF COAL IN BULGARIA BY TYPE OF COAL - 1959 AND PLAN FOR 1962 (Lei Per Metric Ton)

TYPE OF COAL	1959	1962 PLAN
Lignite	62.8	37.4
Brown	62.2	62.6
Hard	232.1	208.6
Anthracite	160.2	116.9
WEIGHTED AVERAGE FOR ALL TYPES	67.6	56.8

Data on the planned development of extraction of coal in Bulgaria, as calculated by the State Planning Commission, reflect the significance these experts attach to the development of lignite production. Of the 14 million ton increment planned in coal production during 1962-65, almost 13.6 million tons is to be provided by growth in the extraction of lignite as shown in the following Table.

TABLE 6-7

PLANS FOR PRODUCTION OF COAL IN BULGARIA - 1962 AND 1965 (Thousand Metric Tons)

TYPE OF COAL	1962 PLAN	1965 PLAN
Lignite	15,010	28,600
Brown	9,580	9,370
Hard	870	1,200
Anthracite	470	830
TOTAL	25,930	40,000

By 1965, about 70 percent of the annual production of lignite is to be provided by the Maritsa-iztok basin. As of January 1, 1958, about 90 percent of the reported reserves of lignite in Bulgaria were contained in this basin. It is because this basin can be exploited through open-pit mining that the costs of production of lignite are expected to decline so rapidly in the coming years.

Almost one-half of all of the coal produced in Bulgaria is extracted from open-pit mines. Because of the planned increase in the production of lignite and the growth in extraction of this fuel at the Maritsa-iztok basin through open-pit methods, it may be expected that the share of open-pit mining will increase in the coming years.

TABLE 6-8

UNDERGROUND MINING OF COAL IN BULGARIA[a] - 1956-1959

YEAR	THOUSAND METRIC TONS	PERCENT OF TOTAL
1956	6,220	57.5
1957	6,225	52.4
1958	6,384	50.1
1959	7,027	45.7

a/ 1/

B. Electric Power

Hydroelectric power stations provide about 30 percent of the reported annual production of electric power in Bulgaria and almost 44 percent of total installed generating capacity in the country. Installed generating capacity in 1958 was 705-megawatts, of which thermal power stations provided 397-megawatts and hydropower stations 308-megawatts.

During the second Five Year Plan, emphasis was given to the construction of hydropower stations. As a result, the construction of hydropower stations during this period accounted for two-thirds of total electric power generating capacity completed for use.

As shown in Table 6-9, the share of hydropower stations in the generation of electric power in Bulgaria has been declining. In the future planning periods, the development of generation of electric power will be based for the most part on the construction of new thermal power stations, and the major fuel for these stations will be lignite from the Maritsa-iztok basin. According to reported plans, by 1965, hydropower output is to represent only 20 percent of the national total and will decline further by 1970-75, to 15 percent and 10 percent respectively.

More than one-half of the available electric power is consumed by industry. In 1958, the last year of which data are available, the electric power consumption pattern in Bulgaria was as follows:

CONSUMER	PERCENT OF TOTAL
Industry	52.7
Transport	2.3
Electric Power Stations	8.3
Other	22.1
Losses in System	14.6
TOTAL	100.0

In addition to the domestic output of electric power, minor quantities are imported from Rumania. These imports (See Table 6-10) reached a peak in 1954 and have been declining since that time.

TABLE 6-9

GENERATION OF ELECTRIC POWER IN BULGARIA
1950, 1955-61 AND PLANS FOR 1962, 1965, 1970, 1975
(Million Kilowatt-Hours)

YEAR	TOTAL	OF WHICH: HYDRO	OF WHICH: THERMAL
1950	797	267	530
1955	2,073	648	1,425
1956	2,393	754	1,639
1957	2,655	830	1,825
1958	2,797	954	1,843
1959	3,869	1,104	2,765
1960	4,657	1,400	3,257
1961	5,500	1,680	3,820
1962 Plan	6-7,000	NA	NA
1965 Plan	10,000	2,000	8,000
1970 Plan	20-22,000	(15%)	(85%)
1975 Plan	30-40,000	(10%)	(90%)

TABLE 6-10

IMPORTS OF ELECTRIC POWER BY BULGARIA
FROM RUMANIA - 1950-1958

YEAR	MILLION KILOWATT-HOURS
1950	22
1951	18
1952	27
1953	40
1954	41
1955	33
1956	27
1958	16

CHAPTER VII

ENERGY IN CZECHOSLOVAKIA

CHAPTER VII *

ENERGY IN CZECHOSLOVAKIA

SECTION 24

SUMMARY

As shown by Table 7-2, coal represents the major source of energy produced in Czechoslovakia. The location of the deposits of the various types of coal is shown on Map No. 16. Hard coal, brown coal, and lignite together have been accounting for more than 93 percent of the primary energy. In recent years there has been a trend toward an increasing proportion of brown coal and lignite and a declining share of hard coal in this total. Natural gas and hydroelectric power each provide several percent of the energy produced, but because of the absence of crude oil reserve, the production of this fuel is insignificant. Consequently, the requirements for petroleum products have to be met almost entirely by imports, as illustrated in the following table.

TABLE 7-1

ESTIMATED PETROLEUM SUPPLY AND DEMAND IN CZECHOSLOVAKIA - 1960 AND 1965 (Thousand Metric Tons)

SUPPLY	1960	1965
Production of Crude Oil	137	200
Natural Gas Liquids and Synthetics	350	350
Imports of Crude Oil and Petroleum Products from the USSR	2,632	6,000
TOTAL SUPPLY	3,119	6,550
DEMAND		
Exports of Crude Oil and Petroleum Products to Free World	50	500
Apparent Domestic Demand	3,069	6,050
TOTAL DEMAND	3,119	6,550

* Except where noted, all data in this Chapter have been taken from Popov, I.V., Energetika stran narodnoy demokratiy (Energy in the Countries of the Peoples Democracy) Moscow, 1961, and Lisichkin, S.M., Neftyanaya promyshlennost' stran narodnoy demodratiy (The Oil Industry in the Countries of the Peoples Democracy), Moscow, 1960.

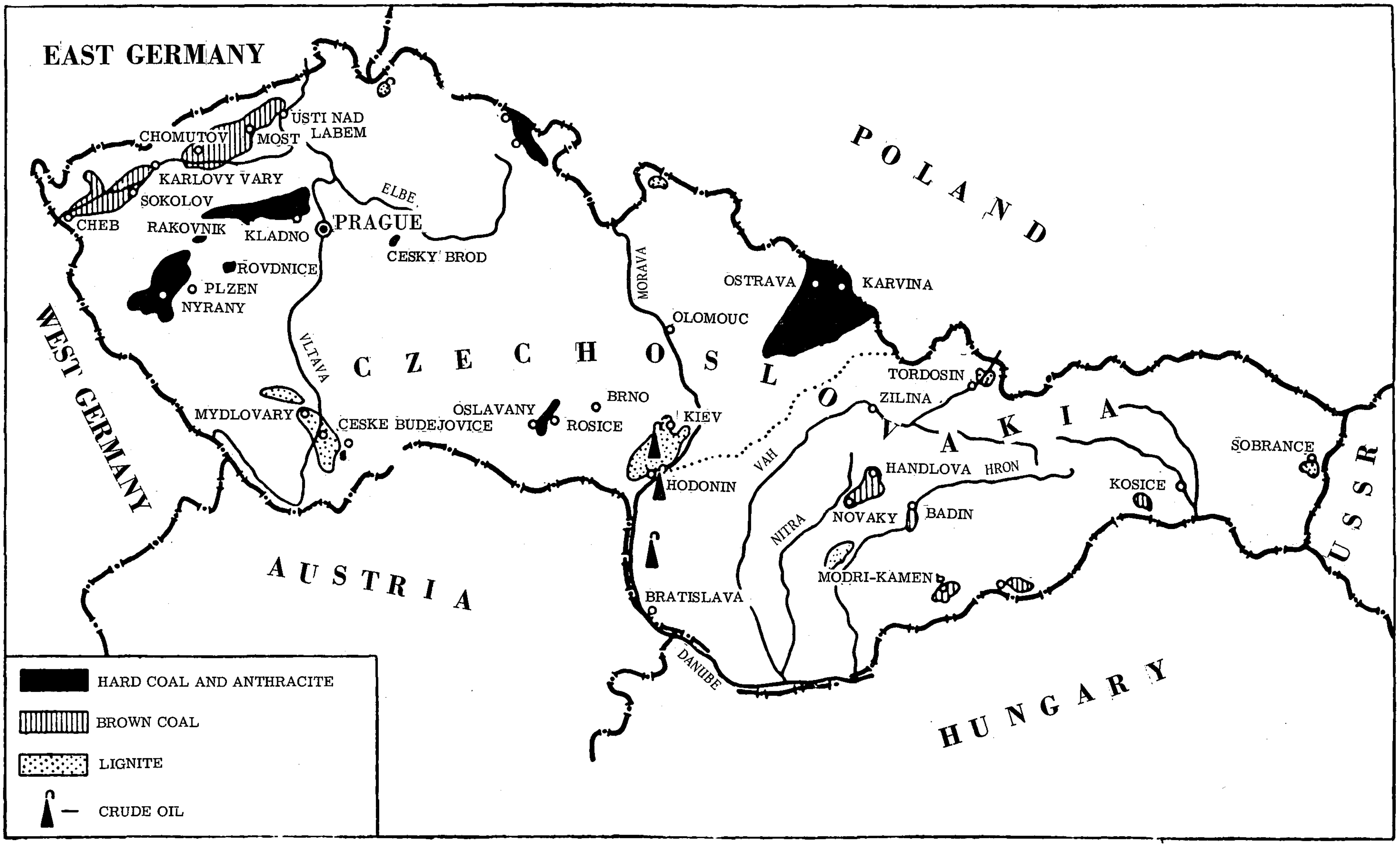
Analysis of the energy potential and of the plans to develop this potential does not indicate the probability of any significant deviation from the energy production structure now prevalent. However, new refining construction is planned so that Czechoslovakia will be able to produce all its required products from imported crude in 1965.

TABLE 7-2

PRODUCTION OF PRIMARY ENERGY IN CZECHOSLOVAKIA
1956 AND 1959-1961
(Million Metric Tons of Standard Fuel)

SOURCE OF ENERGY	1956		1959		1960		1961	
	AMOUNT	PERCENT OF TOTAL	AMOUNT	PERCENT OF TOTAL	AMOUNT	PERCENT OF TOTAL	AMOUNT	PERCENT OF TOTAL
Coal	36.9	96.1	45.1	93.6	47.9	93.6	50.8	93.2
Crude Oil	0.2	0.5	0.2	0.4	0.2	0.4	0.2	0.4
Natural Gas	0.4	1.0	1.9	3.9	1.9	3.7	2.0	3.7
Hydroelectric Power	0.9	2.4	1.0	2.1	1.2	2.3	1.5	2.7
TOTAL	38.4	100.0	48.2	100.0	51.2	100.0	54.5	100.0

MAP NO. 16



DISTRIBUTION OF FUELS-ENERGY RESOURCES OF CZECHOSLOVAKIA

SECTION 25

PETROLEUM IN CZECHOSLOVAKIA

The current level of production of crude oil in Czechoslovakia is only of minor significance. Thus the requirements for petroleum products are met through the refining of imported crude oil and from those small quantities produced by a coal hydrogenation plant. Table 7-3 presents an estimated petroleum supply and demand balance for recent years. Reported production of crude oil is currently about 150 thousand tons per year, but production of liquids from coal hydrogenation is estimated to be somewhat larger. The bulk of demand for petroleum in Czechoslovakia is met by crude imports. In 1960 and 1961, for example, about 90 percent (mostly crude) of requirements were imported from the USSR. In recent years Czechoslovakia has exported small qunatities of products to the Free World.

Reports show that from 1946 through 1958, a total of 1.556 million meters of exploratory drilling was carried out in an effort to discover new deposits of crude oil. This exploratory drilling program resulted in the discovery of only a few small fields, in the central and eastern portions of the Vienna Basin and in the Lower Danube Lowland.

At the present time, 98 percent of the total national output of crude oil is obtained from the Venskiy Basin. Most of the remainder is provided by the Zhatchany field in the so-called Inner Carpathian Basin.

Czechoslovakia has enjoyed more success in expanding its gas industry, both in terms of availability and in the creation of a distribution system, than it has had with the oil industry. Natural gas has represented only a small portion of the total gas available in Czechoslovakia. The larger portions are provided by Lurgi gas and coke oven gas, as described in a later section.

TABLE 7-3

ESTIMATED PETROLEUM SUPPLY AND DEMAND
IN CZECHOSLOVAKIA - 1956-61 AND 1965
(Thousand Metric Tons)

						Committee Estimates	
SUPPLY	1956	1957	1958	1959	1960	1961	1965
Production of Crude Oil a/	108	108	106	123	137	150	200
Natural Gas Liquids plus synthetics b/	350	350	350	350	350	350	350
Imports of Petroleum from USSR c/	805	1,338	1,502	1,922	2,632 b/	3,000	6,000
From Other Bloc Countries	371 d/	265 d/	150 b/	10 e/	0	0	0
TOTAL	1,176	1,603	1,652	1,932	2,632	3,000	6,000
TOTAL SUPPLY	1,634	2,061	2,108	2,405	3,119	3,500	6,550
DEMAND							
Exports to Free World b/	0	0	0	0	50	200	500
Apparent Domestic Demand f/	1,634	2,061	2,108	2,405	3,069	3,300	6,050
TOTAL DEMAND	1,634	2,061	2,108	2,405	3,119	3,500	6,550

a/ Data derived from Table 4-5.
b/ Committee Estimate.
c/ 1/
d/ 2/
e/ 3/
f/ Includes losses and consumption in processing.

TABLE 7-4

PRODUCTION OF NATURAL GAS IN CZECHOSLOVAKIA
1955-56 AND 1959-61
(Million Cubic Meters)

YEAR	AMOUNT
1955	173
1956	274
1959	1,482
1960	1,439
1961	1,500

A. Refining of Petroleum

There is only one major refinery in Czechoslovakia located in the vicinity of Bratislava. Yield patterns of refined products in Czechoslovakia for 1955 and 1958-60 are given in the following Table.

TABLE 7-5

YIELD OF REFINED PRODUCTS IN CZECHOSLOVAKIA
1955 AND 1958-60
(Thousand Metric Tons)

TYPE OF PRODUCT	1955	1958	1959	1960
Gasoline	293 a/	335 a/	371 b/	420 b/
Kerosine	85 a/	69 c/	57 c/	83 c/
Diesel Fuel and Fuel Oils	401 a/	811 c/	981 c/	1,170 c/
Lubricants	100 b/	72 c/	76 c/	79 c/
Others	130 b/	250 b/	180 b/	200 b/
TOTAL	1,009	1,537	1,665	1,952

a/ 4/
b/ Committee Estimate.
c/ 5/

SECTION 26

OTHER ENERGY IN CZECHOSLOVAKIA

A. Coal

The production of coal in Czechoslovakia has increased from about 68 million tons in 1956 to about 90 million tons in 1961, as shown in Table 7-6, primarily through the growth in extraction of hard coal in the Ostrava-Karvina basin and of brown coal from the North Bohemia basin. The extraction of hard coking coal in the Ostrava-Karvina basin is of importance not only to the metallurgical industry of Czechoslovakia, but to other European Satellite nations as well. Almost 99 percent of the total reserves of coking coal of the European Satellites are located within Czechoslovakia and Poland. Thus, the development of coke-chemical industries in other East European countries is dependent upon the import of coking coal from Czechoslovakia and Poland.

TABLE 7-6

PRODUCTION OF COAL IN CZECHOSLOVAKIA
1950 AND 1955-61
(Thousand Metric Tons)

YEAR		HARD COAL	BROWN COAL AND LIGNITE	TOTAL
1950		18,456	27,509	45,965 a/
1955		20,643	40,751	61,394
1956		21,788	46,289	68,077
1957		22,543	51,023	73,566
1958		23,932	56,838	80,770
1959		25,124	53,703	78,827
1960		26,214	57,888	84,102
1961	Committee Estimate	26,000	63,700	89,700

a/ 1/

TABLE 7-7
PRODUCTION OF COAL IN CZECHOSLOVAKIA
BY TYPE AND BY BASIN - 1955 AND 1959
(Thousand Metric Tons)

BASIN	1955	1959
HARD COAL		
Ostrava-Karvina	16,403	19,699
Kladno	2,326	3,085
Plzen	745	852
Trutnov	557	828
Rosice-Oslavany	612	660
TOTAL	20,643	25,124
BROWN COAL AND LIGNITE		
North Bohemia	28,025	36,031
Sokolov	9,724	13,574
South Bohemia	453	482
South Moravia	984	1,021
Slovakia	1,565	2,595
TOTAL	40,751	53,703
GRAND TOTAL	61,394	78,827

Plans for increases in production through 1965 are based primarily on growth in the output of brown coal. The plan for coal extraction in 1965 calls for a total output of 109.4 million tons, to be made up as follows:

TYPE OF COAL	MILLION METRIC TONS
Hard Coal	35.0 a/
Brown Coal	70.2
Lignite	4.2
TOTAL	109.4

a/ 2/

Of the planned production of 35 million tons of hard coal in 1965, about 60 percent is to be coking coal. The increase in the output of coking coal is needed to offset growing exports to other Bloc Countries.

The largest part of Czechoslovakia's gas consumption is provided by coke oven gas and Lurgi gas. The production of gas through the underground gasification of coal is to increase 7 times by 1965, and is to provide about 24 percent of the total gas production in that year.

Total output of gas in Czechoslovakia, including both natural and manufactured gases, is as follows (in million cubic meters):

YEAR	AMOUNT
1948	611
1953	2,980
1954	3,213
1955	3,398
1956	3,534
1957	3,600
1958	4,000

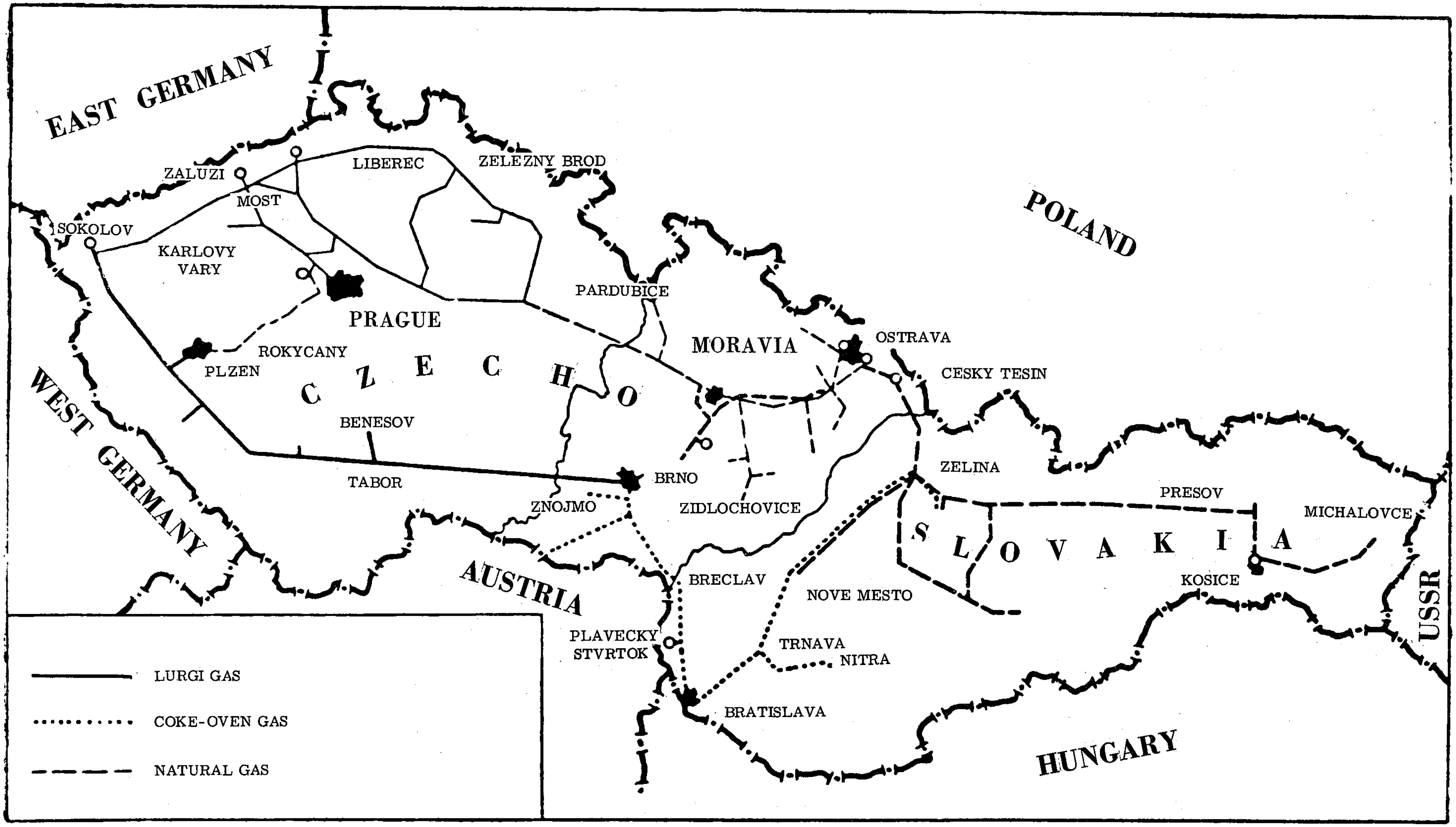
In order to transport the quantities of Lurgi gas, coke oven gas and natural gas from the places of production to the consumers, Czechoslovakia has installed a sizeable transmission gas pipeline system, shown on Map No. 17. In 1945, this system totalled only 450 kilometers in length, but had increased to 2,800 kilometers by 1959. Reported plans call for further increase, to 4,600 kilometers by 1965. In addition, 2,000 kilometers of city gas system are to be added. The transport of natural gas by pipeline is limited to Southern Moravia and to Slovakia. Almost 90 percent of the total gas pipeline network is located in Bohemia, with the remainder in Slovakia.

TABLE 7-8

TOTAL GAS PIPELINES IN CZECHOSLOVAKIA
BY REGION - 1953 AND 1957
(Kilometers)

REGION		1953	1957
Bohemia		3,686	5,116
Slovakia		357	560
	TOTAL	4,043	5,676

MAP NO. 17



TRANSMISSION GAS PIPELINES OF CZECHOSLOVAKIA

According to reports, almost 90 percent of the electric power generated in Czechoslovakia is provided by those power stations which burn coal as a fuel. In addition, hard and brown coals are the chief fuels for rail and river transport. Finally, the raw materials used by the indigenous chemical industry are obtained from coking and brown coals.

The larger portion of the hard coal is used for the production of coke, with lesser amounts directed to electric power stations for the generation of electric power and for the production of heat and steam.

TABLE 7-9

CONSUMPTION OF HARD COAL IN CZECHOSLOVAKIA - 1953 AND 1957 a/
(Percent of Total)

CONSUMER	1953	1957
Production of Coke	32.5	39.4
Production of Electric Power	17.9	19.1
Production of Heat and Steam	15.2	14.1
Transport	10.7	9.5
Production of Gas	3.0	3.4
Other	20.7	14.5
TOTAL	100.0	100.0

a/ 3/

B. Hydroelectric Power

As a share of the national output of electric power, that from hydropower stations reached a peak of 13.3 percent in 1958, but by 1961 had fallen off to about 11 percent of the total, as shown by Table 7-10. On the other hand, the established generating capacity at hydropower stations has gradually been increased, from 11.4 percent of the national total in 1950 to 15.2 percent in 1955 and further to 16.7 percent in 1960. (See Table 7-11)

TABLE 7-10

GENERATION OF ELECTRIC POWER
IN CZECHOSLOVAKIA - 1950-1961
(Million Kilowatt-Hours)

YEAR	TOTAL	OF WHICH FROM HYDROELECTRIC POWER STATIONS
1950	9,280	875
1951	10,296	918
1952	11,634	1,043
1953	12,363	1,014
1955	15,013	1,930
1956	16,591	1,899
1957	17,720	2,121
1958	19,620	2,616
1959	21,884	2,063
1960	24,400	2,495
1961 (Est.)	27,000	3,000

TABLE 7-11

INSTALLED ELECTRIC POWER GENERATING
CAPACITY IN CZECHOSLOVAKIA
1950, 1955 AND 1960
(Million Kilowatts)

YEAR	TOTAL	INCLUDING HYDROPOWER STATIONS
1950	2,440.7	319.8
1955	3,978.9	606.5
1960	5,597.7	937.0

CHAPTER VIII

ENERGY IN EAST GERMANY

CHAPTER VIII *

ENERGY IN EAST GERMANY

SECTION 27

SUMMARY

The primary energy economy of East Germany rests basically on the availability of brown coal and lignite, as depicted by Map No, 18. Crude oil and natural gas production is negligible, and East Germany is dependent on imports or on synthetic oils from coal for its liquid fuel requirements. However, appreciable crude oil production (1 million tons) is forecast for 1965.

In 1961 the production of brown coal and lignite represented 99.5 percent of total energy produced domestically, which is essentially the proportion which has held for recent years, as indicated by Table 8-1. Such production is not sufficient to meet internal energy needs. East Germany has been importing crude oil, hard coal, brown coal and coke in substantial quantities, while exporting brown coal in the form of briquettes and smaller quantities of liquid products.

Little information is available on the breakdown of consumption of fuel internally. In 1956, the last year for which data have been published, the following distribution of consumption of all fuels took place among the various consumers:

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* Except where noted, all data in this Chapter have been taken from Popov, I.V., Energetika stran narodnoy demokratiy (Energy in the Countries of the Peoples Democracy) Moscow, 1961, and Lisichkin, S.M., Neftyanaya promyshlennost' stran narodnoy demokratiy (The Oil Industry in the Countries of the Peoples Democracy), Moscow, 1960.

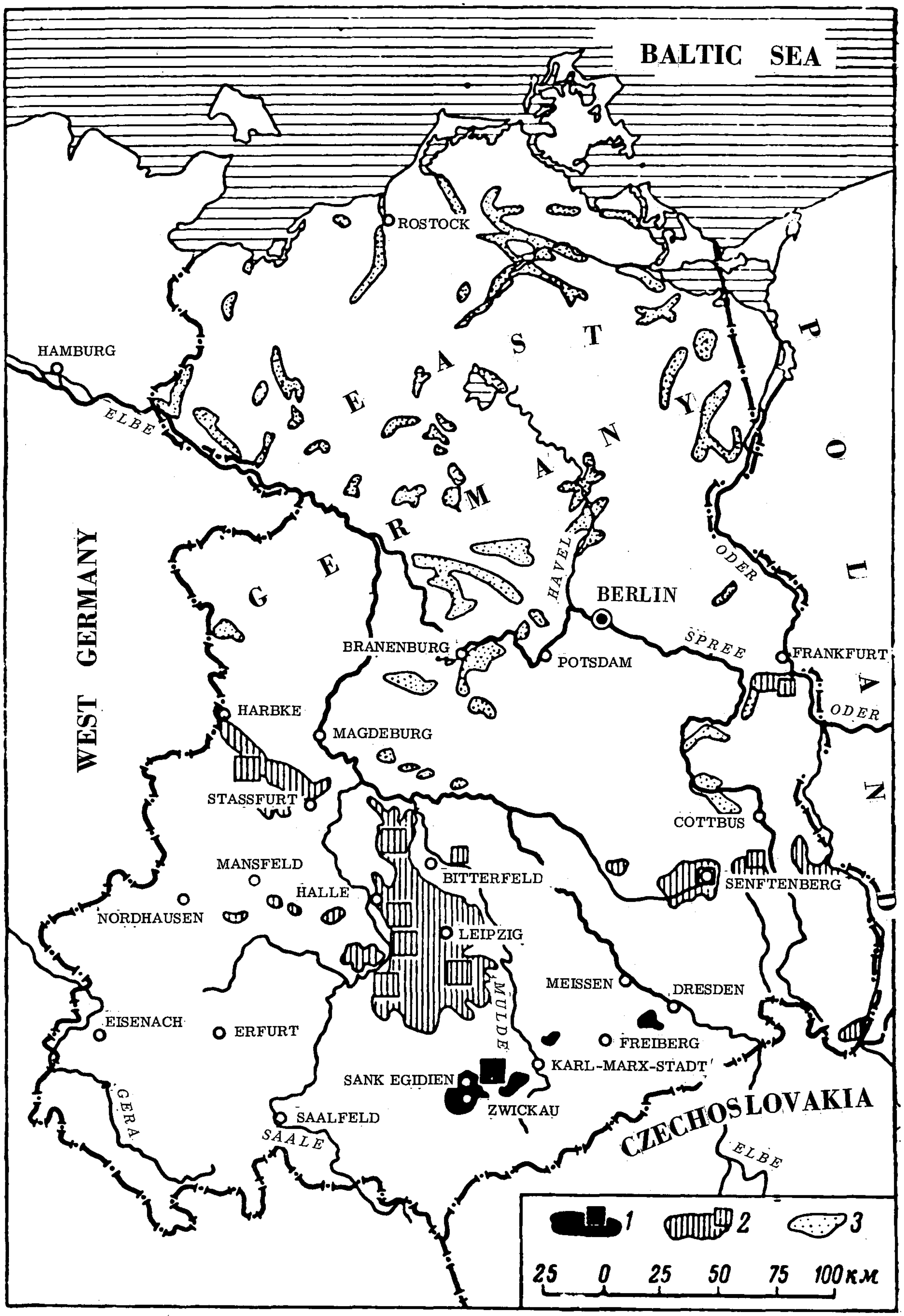
CONSUMER	PERCENT OF TOTAL
Production of Electric Power	32
Communal-Everyday Needs and Local Industry	17
Mining Industry	17
Chemical Industry	10
Transport	10
Other Industry	10
Export	4
TOTAL	100

TABLE 8-1

PRODUCTION OF PRIMARY ENERGY IN EAST GERMANY
1956 AND 1959-1961
(Million Metric Tons of Standard Fuel)

SOURCE OF ENERGY	1956		1959		1960		1961 COMMITTEE ESTIMATE	
	AMOUNT	PERCENT OF TOTAL	AMOUNT	PERCENT OF TOTAL	AMOUNT	PERCENT OF TOTAL	AMOUNT	PERCENT OF TOTAL
Coal	67.1	99.6	69.9	99.6	73.2	99.5	76.4	99.5
Crude Oil	Negl.	0	Negl.	0	Negl.	0	Negl.	0
Natural Gas	Negl.	0	Negl.	0	0.1	0.1	0.1	0.1
Hydroelectric Power	0.3	0.4	0.3	0.4	0.3	0.4	0.3	0.4
TOTAL	67.4	100.0	70.2	100.0	73.6	100.0	76.8	100.0

MAP NO. 18



DISTRIBUTION OF FUELS-ENERGY RESOURCES OF EAST GERMANY

1.- HARD COAL 2.- BROWN COAL 3.- LIGNITE

It is probable that this distribution approximates that within East Germany at the present time.

Through 1965, the growth in domestic demand and increases in exports of petroleum from East Germany are to be met solely by stepped-up imports of petroleum from the USSR as a result of completion of the Comecon oil pipeline.

TABLE 8-2

ESTIMATED PETROLEUM SUPPLY
AND DEMAND IN EAST GERMANY - 1960 AND 1965
(Thousand Metric Tons)

SUPPLY	1960	1965
Production of Crude Oil	2	1,000
Production of Synthetics	2,000	1,000
Imports From USSR	2,167	5,000
TOTAL SUPPLY	4,169	7,000
DEMAND		
Exports - To USSR	231	250
To Other Bloc Countries	200	200
To Free World	750	1,500
TOTAL EXPORTS	1,181	1,950
Apparent Domestic Demand	2,988	5,050
TOTAL DEMAND	4,169	7,000

SECTION 28

PETROLEUM IN EAST GERMANY

A. Production and Consumption

The production of natural crude oil in East Germany at the present time is of only minor significance. Production is centered in two areas--Fallstein and Osterwieck in Thuringia. An encouraging oil find was recently made at Reinkenhagen near Stralsund, in the Baltic coast area, and East Germany plans to bring the production of crude oil to 1 million tons by 1965.

Table 8-3 shows an estimated petroleum supply-demand balance for the years 1956 through 1961, plus an estimate for 1965. Synthetic oils from coal hydrogenation have played a major role in the supply of liquid fuels although crude oil imports from the USSR are increasing rapidly. After the completion of the Comecon pipeline in 1964, crude imports from the Soviet Union should increase to about 4 million tons, and coal hydrogenation probably will be substantially reduced because of its relatively high cost.

Exports of liquid products to the Free World are made mainly to West Germany, with minor amounts to other European countries.

As is the case with crude oil, the extraction of natural gas in East Germany is of little commercial value. Present production is limited to two fields in the Thuringia--one near Muhlhausen and the second at Marolterode--and during the years 1955-61 is reported at the following levels:

YEAR	MILLION CUBIC METERS
1955	20
1956	20
1959	23
1960	40
1961	40

TABLE 8-3

ESTIMATED PETROLEUM SUPPLY AND DEMAND
IN EAST GERMANY - 1956-61 AND 1965 ESTIMATE
(Thousand Metric Tons)

						COMMITTEE ESTIMATE	
SUPPLY	1956	1957	1958	1959	1960	1961	1965
Production of Crude Oil a/	0	0	0	2	2	6	1,000
Production of Synthetics b/	2,000	2,000	2,000	2,000	2,000	2,000	1,000
Imports from USSR c/	750	1,161	1,124	1,802	2,167	2,700	5,000
From Other Bloc Countries d/	22	0	0	0	0	0	0
TOTAL SUPPLY	2,772	3,161	3,124	3,804	4,169	4,706	7,000
DEMAND							
Crude & Product Exports to USSR c/	228	211	225	218	231	200	250
To Other Bloc Countries	155e/	100e/	178b/	200b/	200b/	200	200
To Free World b/	400	500	500	650	750	900	1,500
TOTAL EXPORTS	783	811	903	1,068	1,181	1,300	1,950
Apparent Domestic Demand f/	1,989	2,350	2,221	2,736	2,988	3,406	5,050
TOTAL DEMAND	2,772	3,161	3,124	3,804	4,169	4,706	7,000

a/ Derived from Table 4-5.
b/ Estimated.
c/ 1/
d/ 2/
e/ 3/
f/ Includes losses and consumption in processing.

B. Refining of Petroleum

Because of the absence of published data, it has not been possible to establish yields of refined products in East Germany. The major source for the production of liquid fuels in East Germany has been through the hydrogenation of brown coal tars and the synthesis of carbon monoxide and hydrogen. The production of synthetic liquid fuels is concentrated at enterprises located in Zeitz, Boehlen and Schwarzheide. The hydrogenation plant at Zeitz refines semi-coke from the Espenhein combine and also brown coal tars from semi-coking plants. This plant produces about 650,000 tons of motor fuels and lubricants annually. At the Boehlen hydrogenation plant, where at the present time brown coal tars provide the major raw material for refining, about 450,000 tons of motor fuels are produced. The synthetic gasoline plant at Schwarzheide produces about 230,000 tons of gasoline each year.

Because the production of motor fuel from coal results in a product of much lower quality than that obtained from the refining of natural crude oil, East Germany is attempting to increase its natural crude oil refining capacity. The major effort of this program is the construction of a refinery at Schwedt, on the Oder River. This refinery, to be charged with crude oil from the USSR through the Comecon pipeline, will have an available refining capacity of 1.5 million tons in 1964, increasing to 4 million tons in 1965 and further to 8 million tons by 1970. 4/

There are at present three major refineries in East Germany which are capable of processing natural crude oil. These refineries and their charge capacities are as follows:

REFINERY	CAPACITY (Thousand Metric Tons Per Year)
Leuna	900 to 1,000 a/
Zeitz	750 b/
Luetzkendorf	220 c/
TOTAL	1,870 - 1,970

a/ 5/
b/ 6/
c/ 7/

Reported plans call for an increase in the capacity of the Luetzkendorf refinery to 950,000 tons by 1965.

SECTION 29

OTHER ENERGY

A. Coal

Because East Germany has very limited reserves of hard coal and hydroelectric power and in the absence of a natural crude oil and gas industry, impetus has been given to the development of production of brown coal. The total geological reserves of brown coal have been estimated at 49 billion metric tons, of which 24 billion tons can be produced only through underground mining and the remaining 25 billion tons by open-pit mining. At present, only 2 percent of the brown coal is extracted from underground mines, the remainder provided by open-pit mining. On the other hand, all of the hard coal is mined underground.

Of the total reserves of brown coal, division has been made according to end-use potential. This division is as follows:

END-USE POTENTIAL	PERCENT OF TOTAL
Briquetting	36
Semi-Coking	15
Coking	16
Direct Fuel	27
Other	6
TOTAL	100

Probably about one-half of the annual production of brown coal is used for the production of briquettes. The briquettes are used as a fuel by the railroads, electric power stations, industry and the communal-everyday economy. In addition, the briquettes serve as raw material in the production of semi-coke and brown coal high-temperature coke, gases and tars.

TABLE 8-4

PRODUCTION OF COAL IN EAST GERMANY
BY TYPE - SELECTED YEARS 1950-1961
(Million Metric Tons)

YEAR	BROWN COAL AND LIGNITE	HARD COAL	TOTAL
1950	137.1	2.8	139.9
1952	158.5	2.8	161.3
1954	181.9	2.6	184.5
1955	200.6	2.7	203.3
1956	205.9	2.7	208.6
1957	212.0	2.8	214.8
1958	215.0	2.9	217.9
1959	214.8	2.8	217.6
1960	225.5	2.7	228.2
1961 (Estimate)	236.0	2.6	238.6

TABLE 8-5

PRODUCTION OF BRIQUETTES, SCREENED BROWN COAL,
SEMI-COKE AND BROWN COAL HIGH-TEMPERATURE COKE
IN EAST GERMANY - SELECTED YEARS 1950-1960
(Million Metric Tons)

FUEL	1950	1955	1956	1957	1958	ESTIMATED 1960
Briquettes	37.700	51.000	51.600	53.400	54.000	57.600
Screened Brown Coal	NA	NA	14.500	15.500	16.300	19.700
Semi-Coke	5.224	6.368	6.418	6.625	6.581	NA
Brown Coal High-Temperature Coke	-	0.458	0.732	0.782	0.995	1.060

The growth in the production of briquettes, screened brown coal, semi-coke and brown coal high-temperature coke during the ten-year period from 1950 to 1960 is illustrated in Table 8-5 above.

The expansion of the energy base of East Germany through 1965 will be based primarily on increases in the production of brown coal. In that year brown coal production is to reach to 278 million tons. Of this quantity, 118 million tons, or about 42 percent, is to be provided by production from the Senftenberg Basin. The output of briquettes in 1965 is to reach 63 million tons.

B. Manufactured Gas

East Germany has a comparatively well-developed manufactured gas industry which is based on the production of gas from hard and brown coals. Although at present the larger share, probably about 60 percent, of the manufactured gas is provided from the refining of hard coal, emphasis is shifting to gas produced from brown coal, thus to free hard coal for maximum use in the production of hard coal coke. By 1965, according to reported plans, more than one-half of the total output of manufactured gas is to be derived from brown coal.

TABLE 8-6

PRODUCTION OF GAS* IN EAST GERMANY
SELECTED YEARS 1950-1959

YEAR	AMOUNT
1950	1,498
1952	1,774
1953	1,935
1954	2,217
1955	2,459
1956	2,709
1957	2,766
1958	3,074
1959	3,173

* Includes natural gas.

In order to move these quantities of gas to industrial and communal-everyday consumers, East Germany has created a system of transmission gas pipelines, illustrated on Map No. 19. The length of this system totalled 3,626 kilometers in 1958 and is to increase to 4,300 kilometers by 1965. The gas pipeline construction effort through 1965 is to be concentrated in the installation of a gas pipeline ring designed to link such cities as Schwarze-Pumpe with Stalinstadt, Berlin, Stralsund, Wittenberg, Magdeburg, Halle and Leipzig.

C. Hydroelectric and Electric Power

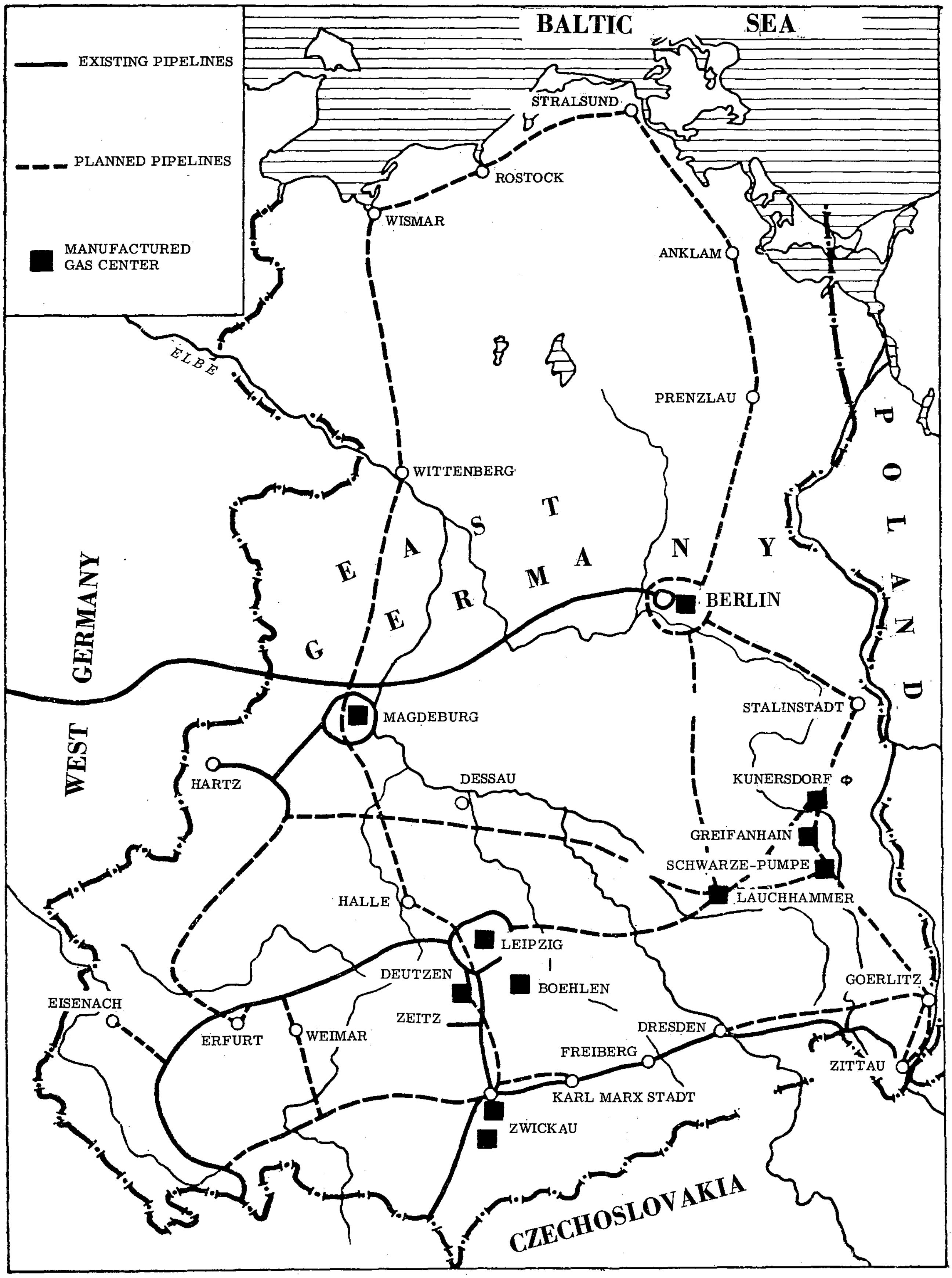
In terms of the annual generation of electric power, that amount from hydroelectric power stations is of minor, declining importance. In 1955, hydropower stations provided 1.7 percent of the total generation of electric power; by 1959 this share had declined to 1.4 percent but at present is holding at 1.5 percent. There are no large hydropower stations in East Germany and none are planned for construction. The shares that the various fuels displayed in the generation of electric power in 1959 are shown in the following table.

TABLE 8-7

SHARE OF HYDROELECTRIC STATIONS IN THE GENERATION OF ELECTRIC POWER IN EAST GERMANY 1955-1956 AND 1959-1961

YEAR	TOTAL OUTPUT (MILLION KILOWATT-HOURS)	INCLUDING HYDROPOWER AMOUNT	INCLUDING HYDROPOWER PERCENT OF TOTAL
1955	28,700	490	1.7
1956	31,182	522	1.7
1959	37,248	536	1.4
1960	40,305	617	1.5
1961	42,000	630	1.5

MAP NO. 19



GAS PIPELINE SYSTEM OF EAST GERMANY

TABLE 8-8

GENERATION OF ELECTRIC POWER IN EAST GERMANY BY TYPE OF FUEL, 1959

FUEL	OUTPUT (MILLION KILOWATT-HOURS)	PERCENT OF TOTAL
Hard Coal	1,660	4.5
Brown Coal	26,636	71.5
Brown Coal Briquettes	2,675	7.2
Semi-Coke	3,839	10.3
Beneficiated Coal	188	0.5
Hydropower Coal	535	1.4
Petroleum	60	0.2
Natural and Manufactured Gas	1,590	4.3
Other	65	0.1
TOTAL	37,248	100.0

Long-range plans have been drawn up for the electric power industry. These plans call for continued rapid growth in the generation of electric power, which is to reach 200 billion kilowatt-hours by 1980.

TABLE 8-9

GENERATION OF ELECTRIC POWER IN EAST GERMANY SELECTED YEARS 1950-1980 (Billion Kilowatt-Hours)

YEAR	AMOUNT
1950	19.5
1955	28.7
1959	37.2
1965	63.0
1970	93.0
1975	138.0
1980	200.0

No significant changes in the pattern of consumption of electric power through 1980 are planned, although the share of industry is to decline by 15 percent. Most of this decline is to be offset by increases in consumption of electric power by the power stations and by projected losses in the system. A comparison of the distribution of consumption of electric power in 1959 and that planned for 1980 is shown in the following table.

TABLE 8-10

ESTIMATED AND PLANNED CONSUMPTION OF ELECTRIC POWER IN EAST GERMANY BY CONSUMER, - 1959 AND 1980 PLAN
(Percent Of Total)

CONSUMER	1959	1980 PLAN
Industry and Transport	70.6	59.5
Agriculture	3.1	5.5
Trade, Crafts, Institutions	5.6	7.5
Everyday Needs	7.0	10.0
Losses in System and Consumption by Electric Power Stations	11.4	17.5
Export	1.0	.0
Other	1.3	.0
TOTAL	100.0	100.0

CHAPTER IX

ENERGY IN HUNGARY

CHAPTER IX *

ENERGY IN HUNGARY

SECTION 30

SUMMARY

The location of producing areas of the major sources of primary energy in Hungary is shown on Map No. 20, and the production of primary energy for recent years is summarized in Table 9-2.

Coal is the major source of energy, providing about 85 percent of the total produced. Crude Oil production recently has ranged from 0.7 to 1.4 million tons per year, which is not sufficient to meet internal requirements. There appears to be no potential for appreciable increases in crude oil output, although the 1965 plan visualizes a rise to 1.7-1.8 million tons per year. Even if the 1965 goal for production of crude oil is reached, more than 60 percent of the demand for petroleum in that year may be met by imports from the USSR, as shown in the following table.

TABLE 9-1

ESTIMATED PETROLEUM SUPPLY AND DEMAND IN HUNGARY - 1960 AND 1965 (Thousand Metric Tons)

SUPPLY	1960	1965
Production of Crude Oil	1,212	1,750
Natural Gas Liquids and Synthetics	50	50
Imports - From USSR	1,449	3,000
TOTAL SUPPLY	2,711	4,800
DEMAND		
Exports - To USSR	60	0
- To Free World	0	250
TOTAL EXPORTS	60	250
Apparent Domestic Demand	2,651	4,550
TOTAL DEMAND	2,711	4,800

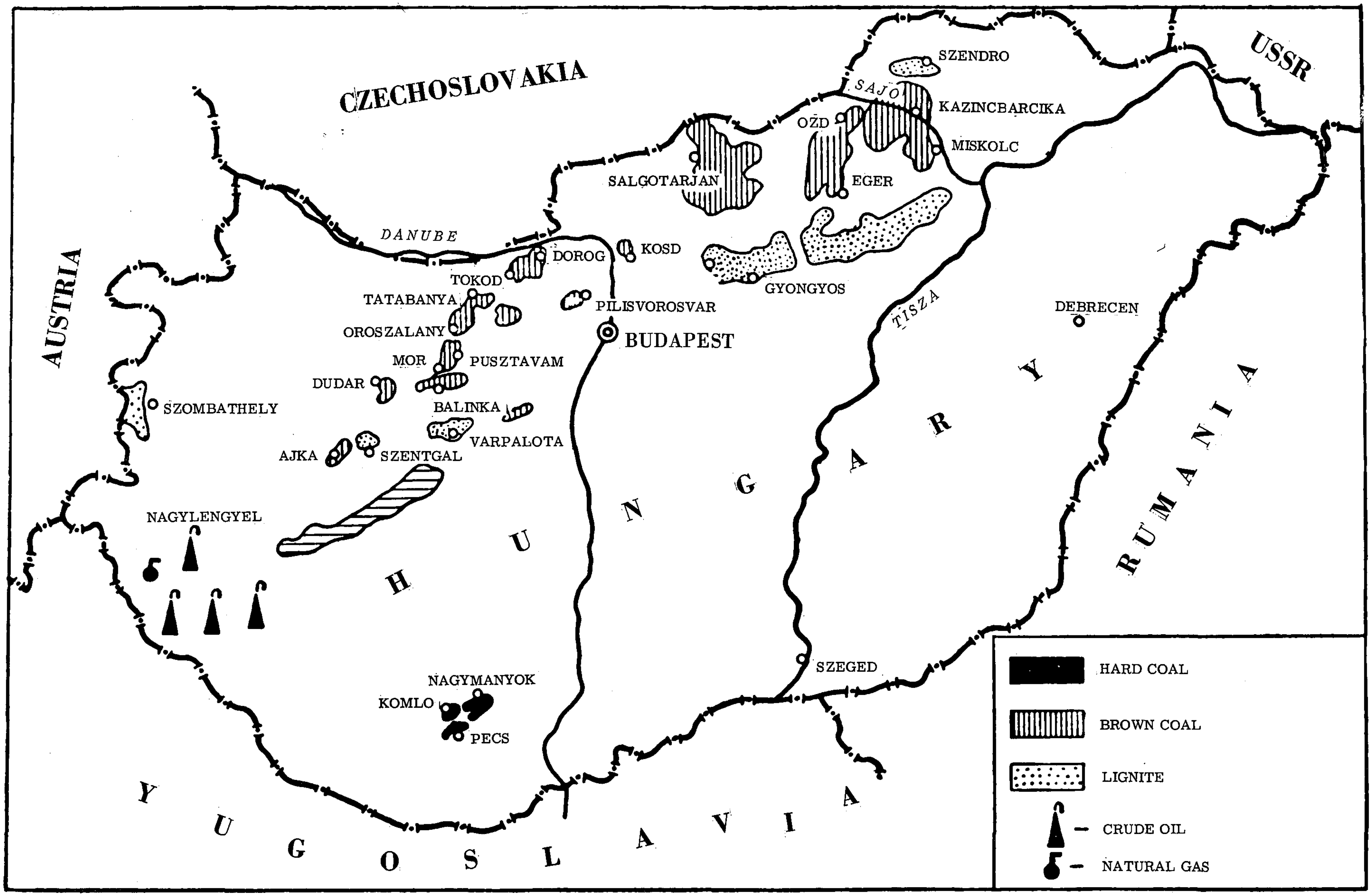
* Except where noted, all data in this Chapter have been taken from Popov, I.V., Energetika stran narodnoy demokratiy (Energy in the Countries of the Peoples Democracy) Moscow, 1961, and Lisichkin, S.M. Neftyanaya promyshlennost'stran narodnoy demokratiy (The Oil Industry in the Countries of the Peoples Democracy), Moscow, 1960.

TABLE 9-2

PRODUCTION OF PRIMARY ENERGY IN HUNGARY
1956 AND 1959-1961
(Million Metric Tons of Standard Fuel)

SOURCE OF ENERGY	1956		1959		1960		1961	
	AMOUNT	PERCENT OF TOTAL	AMOUNT	PERCENT OF TOTAL	AMOUNT	PERCENT OF TOTAL	AMOUNT	PERCENT OF TOTAL
Coal	10.1	81.5	12.3	87.3	12.9	86.0	13.8	84.7
Crude Oil	1.7	13.7	1.4	9.9	1.7	11.3	2.0	12.3
Natural Gas	0.6	4.8	0.4	2.8	0.4	2.7	0.4	2.4
Hydroelectric Power	Negl.	0	Negl.	0	Negl.	0	0.1	0.6
TOTAL	12.4	100.0	14.1	100.0	15.0	100.0	16.3	100.0

MAP NO. 20



DISTRIBUTION OF FUELS-ENERGY RESOURCES OF HUNGARY

SECTION 31

PETROLEUM IN HUNGARY

A. Production and Consumption

Hungary does not have a potential for a major oil-producing economy. Total reserves of crude oil are calculated at 16-20 million tons. At present, the three deposits at Budafapuszta, Lovaszi and Nagylengyel account for 98 percent of total production.

The major producing field is the Nagylengyel deposit, discovered in 1951. This field apparently reached its maximum output in 1955, when it accounted for about 56 percent of the national output.

PRODUCTION OF CRUDE OIL IN HUNGARY
1953-61 AND 1965 PLAN
(Thousand Metric Tons)

YEAR	TOTAL	INCLUDING THE NAGYLENGYEL DEPOSIT AMOUNT	PERCENT OF TOTAL
1953	800	346	43.3
1954	1,200	568	47.3
1955	1,600	906	56.6
1956	1,202	728	60.6
1957	700	363	51.9
1958	800	572	71.5
1959	1,036	NA	NA
1960	1,215	NA	NA
1961	1,440	NA	NA
1965 Plan	1,700-1,800	NA	NA

The peak of production of crude oil was also reached in 1955, some 7 years after the nationalization of the industry. In that year production totalled 1.6 million tons. Following this, the output of crude began to decline, as a portion of the wells became water-encroached. By the end of 1957, production had declined to about 700 thousand tons, but has been gradually rising since that year and reached 1.44 million tons in 1961.

Hungary is dependent on imports, however, for the major sources of its petroleum. Table 9-3 shows that imports have somewhat exceeded production since 1957, and this trend is expected to continue. By 1965 it is planned that production will reach 1.7 to 1.8 million tons per year, and imports from the USSR, mostly crude, are expected to reach 3 million tons. Hungary currently exports minor quantities of products to the Free World.

Only minor quantities of natural gas are produced in Hungary, primarily from the Lispe, Lovaszi, Tolkomlos and Hajdvszoboszlo deposits. Gas from these fields is transported by pipeline to Budapest.

TABLE 9-3

ESTIMATED PETROLEUM SUPPLY AND DEMAND IN HUNGARY - 1956-61 AND 1965 (Thousand Metric Tons)

						Committee Estimates	
SUPPLY	1956	1957	1958	1959	1960	1961	1965
Production of Crude Oil a/	1,202	700	800	1,036	1,215	1,440	1,750
Natural Gas Liquids plus Synthetics b/	50	50	50	50	50	50	50
Imports of Crude Oil and Petroleum Products -							
From USSR c/	346	981	1,141	1,262	1,449	1,500	3,000
From Other Bloc Countries	40	87	60	44	21	0	0
TOTAL IMPORTS	386	1,068	1,201 d/	1,306 d/	1,470	1,500	3,000
TOTAL SUPPLY	1,638	1,818	2,051	2,392	2,735	2,990	4,800
DEMAND							
Crude and Product Exports							
To USSR c/	87	52	130	57	60	0	0
To Free World b/	0	0	0	0	0	200	250
TOTAL EXPORTS	87	52	130	57	60	200	250
Apparent Domestic Demand e/	1,551	1,766	1,921	2,335	2,675	2,790	4,550
TOTAL DEMAND	1,638	1,818	2,051	2,392	2,735	2,990	4,800

a/ Derived from Table 4-5.
b/ Committee Estimate.
c/ 1/
d/ 2/
e/ Includes losses and consumption in processing.

TABLE 9-4

PRODUCTION OF NATURAL GAS IN HUNGARY
SELECTED YEARS, 1949-1958
(Million Cubic Meters)

YEAR	AMOUNT
1949	367.6
1950	379.2
1951	403.1
1952	497.7
1953	546.6
1954	555.5
1955	543.0
1956	425.0
1959	334.0
1960	340.0
1961	320.0

The internal conflict in 1956 which caused a decline in crude oil production also affected the extraction of natural gas, as the data in Table 9-4 above show. It is apparent that a significant increase in natural gas production in coming years is not possible. The plan for 1965 calls for about 300 million cubic meters. It is also apparent that Hungary is to rely upon Rumania as a source of natural gas. The Tissavidekskiy chemical combine, now under construction, will use natural gas delivered by pipeline from Rumania.

B. Refining of Petroleum

Hungary has only one major crude oil refinery in operation. This refinery, located at Szony, has a reported charge capacity of 1.5 million tons, which represents about 60 percent of the national total. Another refinery, to be located at Szazhalombatta, is planned for construction in 1963, with the first stage to be completed in 1965. This refinery will have an ultimate crude oil charge capacity of 3 million tons and will refine crude oil delivered through a branch pipeline leading off the Czechoslovakian portion of the Comecon pipeline.

Except for a decline in the share of kerosine and about a 30 percent increase in the share of diesel fuel, the pattern of output of refined products in Hungary did not change appreciably during 1955-1960. The major product continues to be fuel oil, which accounts for about 40 percent of total products. Yield patterns of refined products in Hungary for the years 1955 and 1958-1960 are shown in the following table.

TABLE 9-5

YIELD OF REFINED PRODUCTS IN HUNGARY - 1955 and 1958-1960 (Thousand Metric Tons)

TYPE OF PRODUCT	1955 a/	1958 b/	1959 c/	1960
Gasoline	187	272	301	329 d/
Kerosine	65	47	45	40 e/
Diesel Fuel	351	521	641	731 d/
Lubricants	84	82	88	100 e/
Fuel Oil	653	682	835	987 d/
Others*	215	284	311	313 e/
TOTAL	1,555	1,888	2,221	2,500

* Includes natural gasoline, greases, wax and asphalt.

a/ 3/
b/ 4/
c/ 5/
d/ 6/
e/ Estimate.

SECTION 32

OTHER ENERGY

A. Coal

Brown coal accounts for the major share--approaching 75 percent--of annual coal output in Hungary and for a similar share in increases in production.

TABLE 9-6

PRODUCTION OF COAL IN HUNGARY, BY TYPE - 1954-61
(Thousand Metric Tons)

YEAR	HARD COAL	BROWN COAL	LIGNITE	TOTAL
1954	2,435	16,024	3,077	21,536
1955	2,692	16,249	3,375	22,316
1956	2,371	14,990	3,229	20,590
1957	2,280	15,528	3,384	21,192
1958	2,626	17,779	3,844	24,249
1959	2,734	18,539	4,074	25,347
1960	2,847	19,446	4,230	26,523
1961	3,000	25,400		28,400

The internal revolution in 1956 depressed the production of coal in that year to about 90 percent of production in 1955. The resulting shortage of fuel forced the closing of a number of industrial enterprises, despite the fact that the USSR and Poland alone delivered to Hungary about 7,000 tons of coal each day.

In 1957, as shown by Table 9-7, industry consumed 72.3 percent of total coal available, and about one-half of this quantity was burned in the generation of electric power.

Published long range plans through 1965 do not call for any significant change in the absolute growth in the production of coal. On the contrary, the growth planned for 1961-65--3 to 5 million tons--would be comparable to that achieved in the preceding 5 year period.

TABLE 9-7

CONSUMPTION OF COAL IN HUNGARY - 1957

CONSUMER	THOUSAND METRIC TONS	PERCENT OF TOTAL
Coal Industry	483.3	2.2
Production of Briquettes	585.7	2.6
Light Metallurgy	353.1	1.6
Heavy Metallurgy	1,791.6	8.0
Electric Power Stations	7,465.3	33.3
Construction Materials	1,542.6	6.9
Chemical	1,352.5	6.0
Textiles	495.4	2.2
Food, Wine-Making and Tobacco	1,062.0	4.7
Other Industry	1,078.1	4.8
INDUSTRY TOTAL	16,209.6	72.3
Railroads	1,912.0	8.5
Communal Economy	2,896.8	12.9
Other Consumers	1,411.9	6.3
TOTAL	22,430.3	100.0

B. Hydroelectric Power

Hydroelectric power as a source of energy in Hungary is of virtually no significance. Of the total installed capacity of 1.06 million kilowatts in 1958, only 10 thousand kilowatts or about 1 percent were provided by hydropower stations. In turn, these stations provide only 1.5 percent of total electric power generated. Although the total output of electric power has increased from 5.43 billion kilowatt-hours in 1955 to 7.60 billion kilowatt-hours in 1960, such growth has not been sufficient to meet the needs of the expanding economy. As a result, about 5 percent of the annual demand for electric power must be met by imports from neighboring countries.

CHAPTER X

ENERGY IN POLAND

CHAPTER X *

ENERGY IN POLAND

SECTION 33

SUMMARY

Coal, particularly hard coal, not only provides the larger share of the energy base of the country, but also is a chief article of export. Hard coal is exported to other East Europe countries and the Soviet Union, and to such West Europe nations as Finland, Austria and Sweden. A small amount of petroleum is indigenous to the country, and production of crude is stabilized at a level which meets only about 7 percent of current demand, and as shown in Table 10-1, the remainder is supplied by imports, primarily from the USSR.

TABLE 10-1

ESTIMATED PETROLEUM SUPPLY AND DEMAND IN POLAND - 1960 AND 1965 (Thousand Metric Tons)

SUPPLY	1960	1965
Production of Crude Oil	194	300
Imports of Petroleum - From USSR	2,045	4,700
From Other Bloc Countries	558	200
TOTAL IMPORTS	2,603	4,900
TOTAL SUPPLY	2,797	5,200
DEMAND		
Exports to Free World	150	300
Apparent Domestic Demand	2,647	4,900
TOTAL DEMAND	2,797	5,200

* Except where noted, all data in this Chapter have been taken from Popov, I.V., Energetika stran narodnoy demokratiy (Energy in the Countries of the Peoples Democracy) Moscow, 1961, and Lisichkin, S.M., Neftyanaya promyshlennost' stran narodnoy demokratiy (The Oil Industry in the Countries of the Peoples Democracy), Moscow, 1960.

The locations of coal, oil and gas deposits are shown on Map No. 21.

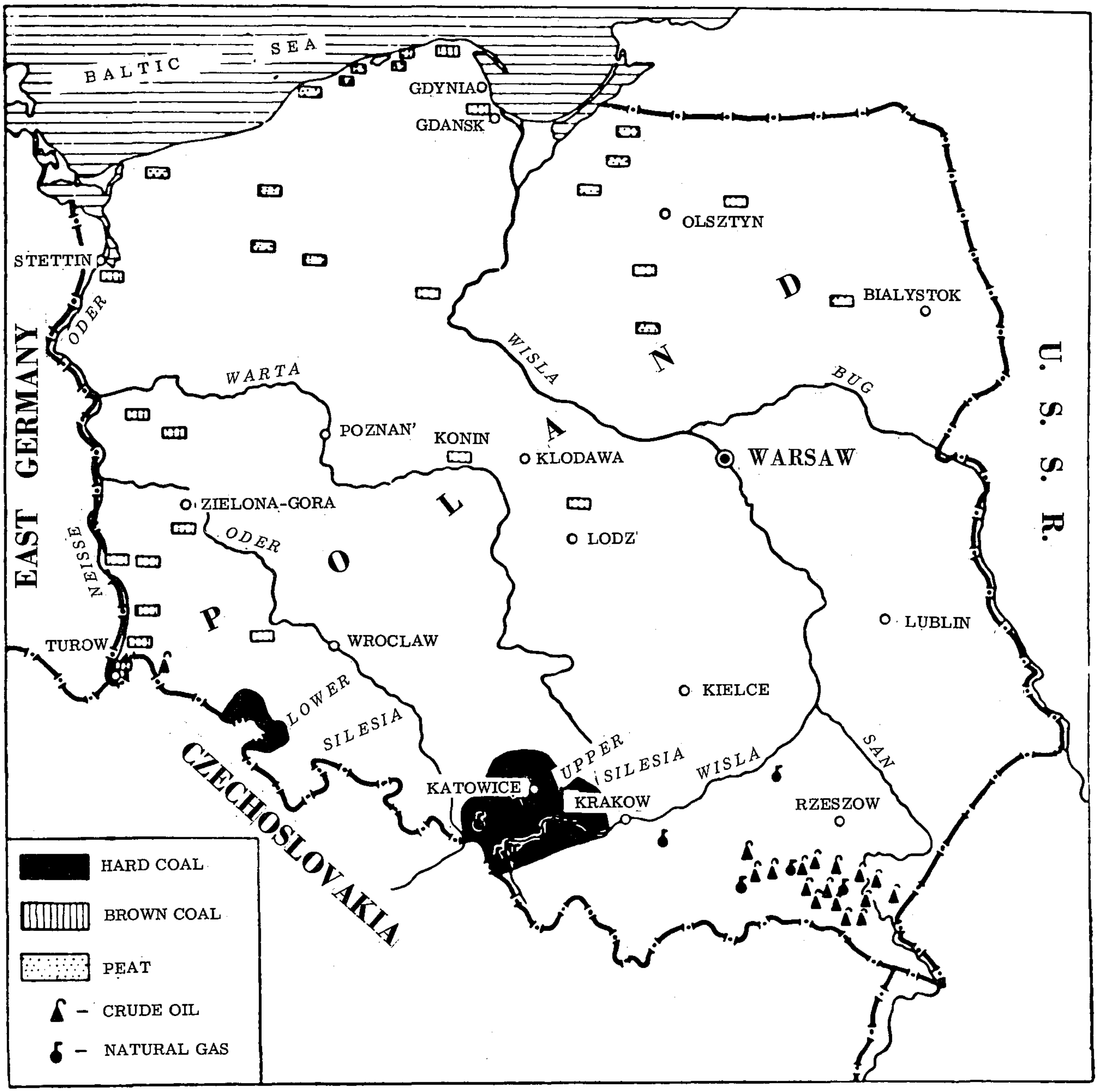
The program for 1975 calls for increasing crude oil production from 180,000 tons today to 650,000 tons in 1975. Comparing this with estimated consumption of 7.5 to 10 million tons in 1975, shows the continuing dependence on imports from the USSR.

TABLE 10-2

PRODUCTION OF PRIMARY ENERGY IN POLAND
1956 AND 1959-1961
(Million Metric Tons of Standard Fuel)

SOURCE OF ENERGY	1956		1959		1960		1961	
	AMOUNT	PERCENT OF TOTAL	AMOUNT	PERCENT OF TOTAL	AMOUNT	PERCENT OF TOTAL	AMOUNT	PERCENT OF TOTAL
Coal	83.3	98.5	87.6	98.7	92.2	98.6	94.3	98.4
Crude Oil	0.3	0.4	0.3	0.3	0.3	0.3	0.3	0.3
Natural Gas	0.6	0.7	0.6	0.7	0.7	0.8	0.9	0.9
Hydroelectric Power	0.3	0.4	0.3	0.3	0.3	0.3	0.4	0.4
TOTAL	84.5	100.0	88.8	100.0	93.5	100.0	95.9	100.0

MAP NO. 21



DISTRIBUTION OF FUELS-ENERGY RESOURCES OF POLAND

SECTION 34

PETROLEUM IN POLAND

A. Production and Consumption

The production of crude oil in Poland has been stabilized at an annual output level of 180,000 - 190,000 tons since 1954. In terms of the annual demand for petroleum products, the domestic availability of crude oil is sufficient to meet only 7 percent of such requirements. Table 10-3 summarizes the estimated petroleum supply-demand situation for Poland from 1956 through 1961 and 1965. The major source of Poland's present petroleum supply is the USSR. Imports of crude oil are expected to increase substantially with the completion of the Comecon pipeline in 1964.

TABLE 10-3

ESTIMATED PETROLEUM SUPPLY AND DEMAND IN POLAND - 1956-61 AND 1965 (Thousand Metric Tons)

						Committee Estimates	
SUPPLY	1956	1957	1958	1959	1960	1961	1965
Production of Crude Oil a/	184	181	175	175	194	200	300
Imports of Crude Oil and Petroleum Products -							
From USSR b/	863	1,328	1,518	1,781	2,045	2,250	4,700
From Other Bloc Countries	626 c/	410 c/	400 d/	400 d/	400 d/	400	200
TOTAL IMPORTS	1,489	1,738	1,918 e/	2,181 e/	2,445 e/	2,650	4,900
TOTAL SUPPLY	1,673	1,919	2,093	2,356	2,639	2,850	5,200
DEMAND							
Exports to Free World d/	0	0	0	0	150	200	300
Apparent Domestic Demand f/g/	1,673	1,919	2,049	2,378	2,647	3,050	4,900
TOTAL DEMAND	1,673	1,919	2,049	2,378	2,797	3,250	5,200

a/ Derived from Table 4-5.
b/ 1/
c/ 2/
d/ Committee Estimate.
e/ 3/
f/ Minor inconsistencies exist compared with other numbers in this report.
g/ Includes losses and consumption in processing.

The requirements for petroleum products will continue to grow as the economy expands. In an effort to increase the domestic availability of crude oil, a major geological-exploratory program has been outlined for the Carpathians, the foothill area and the Polish lowlands. The area within which the exploratory program is to be carried out totals about 250,000 square kilometers, of which about 205,000 square kilometers are in the Polish lowlands. This program, for the period 1961-1975, calls for 72,000 kilometers of seismic profile, 180,000 gravimetric points, and 4 million meters of exploratory drilling. Even so, the production of crude oil in Poland is projected to reach only about 650,000 tons by 1975.

The latter figure would still be a very small portion of predicted 1975 demand. Table 10-4 shows that the consumption of petroleum product has grown from 540,000 tons in 1949 to 2.6 million tons in 1960, and that it is expected to reach 7.5 to 10.0 million tons by 1975.

TABLE 10-4

GROWTH IN CONSUMPTION OF PETROLEUM PRODUCTS IN POLAND - 1949, 1955, 1960 AND 1975

YEAR		(THOUSAND METRIC TONS)
1949		540
1955		1,526
1960		2,600
1975	- Minimum	7,500
	Maximum	10,000

Extraction of natural gas in Poland, essentially from deposits in the Carpathians, has increased from 135 million cubic meters in 1940 to 700 million cubic meters in 1961. Little expansion in the domestic output of natural gas is anticipated; output may reach 800 million cubic meters by 1975. The degasification of hard coal strata also provides small quantities of methane.

TABLE 10-5

PRODUCTION OF NATURAL GAS IN POLAND - 1955-1956 AND 1959-1961

YEAR	AMOUNT (MILLION CUBIC METERS)
1955	349
1956	435
1959	424
1960	549
1961 (Committee Estimate)	700

The demand for natural gas in Poland is in excess of annual production, and it is probable that this gap will continue to increase, as shown in the following:

DEMAND FOR NATURAL GAS IN POLAND

YEAR	AMOUNT (MILLION CUBIC METERS)
1955	488
1960	791
1975 - Minimum	1,300
Maximum	2,000

The deficit between natural gas consumption and production is made up by natural gas imported by pipeline from the Dashava fields in the Western Ukraine. Such imports have increased from about 139 million cubic meters in 1955 to 242 million cubic meters in 1960, as illustrated by Table 10-6.

TABLE 10-6

IMPORTS OF NATURAL GAS BY POLAND FROM THE WESTERN UKRAINE - 1955-60

YEAR	AMOUNT (MILLION CUBIC METERS)
1955	138.7
1956	136.2
1957	170.0
1958	205.6
1959	222.0
1960	242.0

To transport the quantities of natural gas to consumers in Warsaw and to the Silesia industrial complex, about 1,300 kilometers of transmission pipeline have been installed. Additional pipeline service between the Ukraine and Poland is now under construction and upon completion of the facilities, deliveries may reach 1 billion cubic meters by 1965.

The greater portion of natural gas consumed in Poland is diverted towards meeting the needs of industry. The structure of consumption of natural gas in 1958 was as follows:

CONSUMER	PERCENT OF TOTAL
Industry	
Heavy	35.4
Chemical	18.0
Other	18.0
TOTAL	71.4
Everyday Needs	28.6
TOTAL	100.0

B. Refining of Petroleum

Total crude oil charge capacity available in Poland in 1961 is estimated at 1.3 million tons. 4/ Distribution of this capacity among the several refineries of the country is as follows:

REFINERY	CAPACITY (THOUSAND METRIC TONS)
Czechowice	500 a/
Gorlice	150
Jaslo)	
Jedlicze)	
Limanowa Sowliny)	650
Trzebinia)	
TOTAL	1,300

a/ 5/

Completion of construction of the Plock refinery on the branch of the Comecon pipeline will significantly augment available refinery capacity in Poland. The first section of the Plock refinery is scheduled for completion in 1964 and at that time, refinery capacity is to reach to 2 million tons. Completion of additional sections is to raise the capacity to 4 million tons by 1966 and to 6 million tons by 1968. 6/

Yields of refined products in Poland show that approximately equal proportions have been allocated to gasoline, diesel fuel and the category "residuals and others." Virtually all of the remainder is provided by lube oils. With the Plock refinery partially on stream in 1965, it is estimated that the yield of refined products in that year will be 3.28 million tons. 8/

TABLE 10-7

YIELDS OF REFINED PRODUCTS IN POLAND - 1955 AND 1958-60 a/
(Thousand Metric Tons)

PRODUCT	1955	1958	1959	1960
Gasoline	122	189	205	219
Kerosine	28	8	13	6
Diesel Fuel	134	197	204	240
Lube Oils	127	145	160	142
Residuals and Others*	252	191	192	243
TOTAL	663	730	774	850

* Includes asphalt, lubricants, wax and fuel oil.
a/ 7/

SECTION 35

OTHER ENERGY OF POLAND

A. Coal

The major hard coal basins in Poland are the Upper-Silesia basin with its center at Katowice and Lower-Silesia with its center at Walbrzyzh. These two basins are reported to contain 99.6 percent of all reserves of hard coal in the European Satellite nations. Of the 5,400 square kilometers contained within the upper Silesia coal basin, 4,800 square kilometers are located within Poland.

Indications are that little effort is to be expended in the next few years to increase the output of hard coal. Polish planners anticipate that production of hard coal is to reach to only 112 million tons by 1965, a gain of about 9 percent in a five-year period. Plans which cover production through 1975 call for an output in that year of only 130 million tons.

TABLE 10-8

PRODUCTION, EXPORTS AND APPARENT CONSUMPTION OF HARD COAL IN POLAND - SELECTED YEARS 1950-61 (Million Metric Tons)

YEAR	PRODUCTION	EXPORTS	APPARENT CONSUMPTION
1950	78.3	26.6	51.7
1953	88.7	24.2	64.5
1954	91.7	24.2	67.5
1955	94.5	24.1	70.4
1956	95.1	19.2	75.9
1957	99.8	17.4	82.4
1958	95.0	NA	NA
1959	99.1	NA	NA
1960	104.4	NA	NA
1961	106.6	NA	NA

To offset this relatively slow rate of growth and to ensure that the needs of the country for coal are to be met, while at the same time allowing for exports of hard coal, much larger increases in production are planned for brown coal.

The brown coal industry, which in the past has not been given an opportunity for expansion, is to grow quite rapidly in the coming years, as illustrated in the following:

YEAR	PRODUCTION (MILLION METRIC TONS)
1950	5.2
1956	6.2
1958	7.5
1959	9.3
1960	9.3
1965 Plan	27.0
1975 Plan	50.0

Thus, within a period of five years, the share of brown coal in the total output of coal is to increase from about 8 percent in 1960 to more than 19 percent in 1965.

City gas plants and gas produced by coke ovens provide a much larger source of gas in Poland than does natural gas. The manufacture of city gas, primarily from hard coal, hard coal-water and generator sources, reached about 700 to 800 million cubic meters in 1960.

The manufacture of coke oven gas is centered in Upper Silesia and Lower Silesia. Of those coking plants associated with metallurgical factories, about 14 percent of the total output of coke oven gas is placed into the gas distribution system. A much higher share, about 42 percent, of the gas is placed into the distribution system at those coking plants not associated with the metallurgical industry. Coke oven gas in Poland is consumed in the following pattern:

CONSUMER	PERCENT OF TOTAL
Metallurgy	43.8
Machine Construction	4.9
Chemical Industry	6.8
Boilers	25.3
Other Industry	5.9
TOTAL INDUSTRY	86.7
Household	9.4
Other Consumers and Losses	3.9
TOTAL	100.0

B. Hydroelectric Power

The hydroelectric power potential of Poland is quite small. Consequently, the generation of electric power by this means provides only a minor and currently, declining, portion of the total national output. In 1960, as shown in Table 10-9, hard coal was the source of more than 93 percent of electric power generated in that year. However, the absolute consumption of hard coal in the generation of electric power in the five-year period through 1965 is to be held constant and emphasis shifted to brown coal.

TABLE 10-9

SOURCES OF ENERGY IN THE GENERATION OF ELECTRIC POWER IN POLAND - SELECTED YEARS 1955-75
(Percent of Total)

SOURCE OF ENERGY	1955	1960	1965	1970	1975
Hard Coal	95.3	93.3	68.0	49.7	43.1
Brown Coal	0.7	4.6	28.4	42.0	44.8
Hydropower	4.0	2.1	3.6	4.8	6.4
Nuclear Energy	.0	.0	.0	3.5	5.7
TOTAL	100.0	100.0	100.0	100.0	100.0

Total hydroelectric generating capacity in Poland is estimated at 250-megawatts, of which 100-megawatts is provided by the Rozhkuv and Dykhuv hydrostations. The remaining capacity is found in about 120 small hydrostations. Plans call for the construction of a number of hydrostations on the Visly River, which, if completed, would support the planned increased share of hydrostations in the output of electric power.

CHAPTER XI

ENERGY IN RUMANIA

CHAPTER XI *

ENERGY IN RUMANIA

SECTION 36

SUMMARY

Rumania ranks second to the Soviet Union among the countries of the Sino-Soviet bloc in terms of reserves of crude oil and natural gas. These fuels account for 89 percent of the energy production in the country, with the remainder being largely coal, as shown in Table 11-1. The general locations of producing fields are shown on Map No. 22.

The share of crude oil in energy production has been declining in recent years, as the extraction of natural gas has expanded while crude oil production has been relatively constant at 11 to 12 million tons per year. It is estimated that by 1965, crude oil and natural gas should provide equal portions of energy production.

Petroleum consumption is less than production, and Rumania is a substantial exporter of liquid products, as well as a minor exporter of natural gas. Recently liquid product exports to the Free World have run about 3 million tons per year, and to the USSR about 2.8 million tons per year. In 1960, as shown in Table 11-2, exports of petroleum from Rumania exceeded the apparent domestic demand, if only slightly. A decline in the volume of petroleum exported is anticipated, as is a growth in domestic demand. Thus by 1965, demand probably will exceed exports by more than 60 percent.

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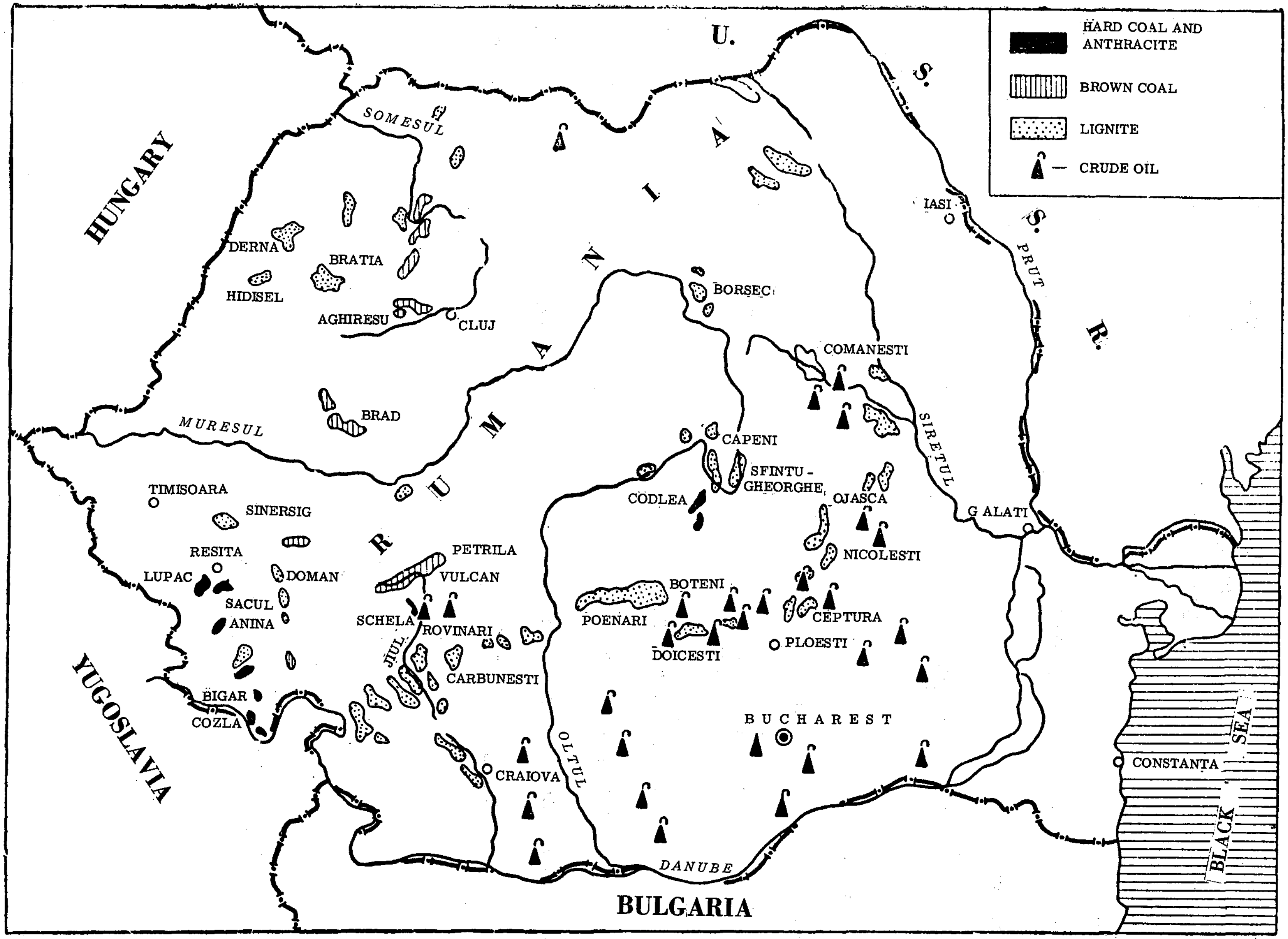
* Except where noted, all data in this Chapter have been taken from Popov, I.V., _Energetika stran narodnoy demokratiy_ (Energy in the Countries of the Peoples Democracy) Moscow, 1961, and Lisichkin, S.M., _Neftyanaya promyshlennost' stran narodnoy demokratiy_ (The Oil Industry in the Countries of the Peoples Democracy), Moscow, 1960.

TABLE 11-1

PRODUCTION OF PRIMARY ENERGY IN RUMANIA
1956 AND 1959-1961
(Million Metric Tons of Standard Fuel)

SOURCE OF ENERGY	1956		1959		1960		1961	
	AMOUNT	PERCENT OF TOTAL	AMOUNT	PERCENT OF TOTAL	AMOUNT	PERCENT OF TOTAL	AMOUNT	PERCENT OF TOTAL
Coal	2.8	9.9	3.4	10.2	3.6	10.4	3.8	10.6
Crude Oil	16.4	57.7	17.2	51.7	17.2	49.5	17.5	48.7
Natural Gas	9.1	32.0	12.6	37.8	13.7	39.5	14.4	40.1
Hydroelectric Power	0.1	0.4	0.1	0.3	0.2	0.6	0.2	0.6
TOTAL	28.4	100.0	33.3	100.0	34.7	100.0	35.9	100.0

MAP NO. 22



DISTRIBUTION OF FUELS-ENERGY RESOURCES OF RUMANIA

TABLE 11-2

ESTIMATED PETROLEUM SUPPLY AND DEMAND
IN RUMANIA - 1960 AND 1965
(Thousand Metric Tons)

	1960	1965
SUPPLY		
Production of Crude Oil	11,500	12,500
Imports	0	0
TOTAL SUPPLY	11,500	12,500
DEMAND		
Exports - To USSR	2,823	2,500
To Other Bloc Countries	508	0
To Free World	2,632	2,250
Total Exports	5,963	4,750
Apparent Domestic Demand	5,537	7,750
TOTAL DEMAND	11,500	12,500

SECTION 37

PETROLEUM IN RUMANIA

A. Crude Oil Production and Consumption

Although Rumania may be described as the second leading producer of crude oil in the Sino-Soviet bloc, its output of crude oil in 1961 was equivalent to only 7 percent of crude oil production in the Soviet Union in that year. In addition, while the extraction of Rumanian crude has become fairly well stabilized--an increase of only 1 million tons is planned for the period 1960-65--that of the Soviet Union continues to expand at a rapid rate. As a further comparison, the added increment in production of crude oil in the Soviet Union in 1961 over 1960 was equivalent to almost 1.7 times Rumanian production.

Nevertheless, Rumania continues to produce crude oil in excess of domestic requirements. This allows exports of crude oil and products from Rumania on Rumanian or on Soviet account to the West and to other countries of the Bloc. Table 11-3 summarizes the estimated crude and product demand balance for the years 1956 to 1961, and estimates a balance for 1965.

The production of crude oil during 1956-61 increased by a total of only 0.7 million tons. Available data indicate that this increment may be wholly attributable to the introduction of a program of pressure maintenance through water and gas injection. In 1958, a total of 8.27 million cubic meters of water and 228 million cubic meters of gas was injected. It is claimed that these methods provide for an additional 10 percent of annual extraction or about 1 million tons. In addition, the hydraulic fracturing of strata reportedly provides more than 500,000 tons of crude oil per year.

The number of oil wells in production in Rumania reached 4,322 in 1958. The average daily yield per well in that year was about 53 barrels, up from about 42 barrels per day in 1951, when 2,978 wells were in production.

The major share of the annual output of crude oil is now obtained from new regions, as shown in Table 11-4. To some extent this is the result of expanded exploratory and development drilling operations which reached a peak in 1952.

TABLE 11-3

ESTIMATED PETROLEUM SUPPLY AND DEMAND
IN RUMANIA - 1956-61 AND 1965
(Thousand Metric Tons)

						COMMITTEE ESTIMATE	
SUPPLY	1956	1957	1958	1959	1960	1961	1965
Production of Crude Oil a/	10,920	11,180	11,336	11,437	11,500	11,650	12,500
Imports	0	0	0	0	0	0	0
TOTAL SUPPLY	10,920	11,180	11,336	11,437	11,500	11,650	12,500
DEMAND							
Crude and Product Exports							
To USSR b/	3,437	2,582	2,824	2,956	2,823	2,800	2,500
To Other Bloc Countries	1,041 c/	756 c/	544 d/	476 d/	508 d/	550	0
To Free World	1,376 d/	1,403 d/	1,696	2,442	2,632	3,000	2,250
TOTAL	5,854	4,741	5,064 e/	5,874 e/	5,963 e/	6,350	4,750
Apparent Domestic Demand f/	5,066	6,439	6,272	5,563	5,537	5,300	7,750
TOTAL DEMAND	10,920	11,180	11,336	11,437	11,500	11,650	12,500

a/ Derived from Table 4-5.
b/ 1/
c/ 2/
d/ Committee Estimate.
e/ 3/
f/ Includes losses and consumption in processing.

TABLE 11-4

GROWING SHARE OF NEW OIL FIELDS IN RUMANIAN CRUDE OIL PRODUCTION - 1950-1958 (Percent Of Total)

YEAR	OLD FIELDS	NEW FIELDS	TOTAL
1950	95.4	4.6	100
1951	84.1	15.9	100
1952	71.0	29.0	100
1953	66.3	33.7	100
1954	59.9	40.1	100
1955	50.4	49.6	100
1956	41.9	58.1	100
1957	36.4	63.6	100
1958	33.9	66.1	100

By 1958, the total volume of drilling had fallen from its peak of 980 thousand meters to only 665 thousand meters, approximately equalling the amount drilled in 1950, as shown in Table 11-5.

It can be seen that although total drilling is decreasing, a growing proportion of effort is being spent on exploratory drilling.

TABLE 11-5

EXPLORATORY AND DEVELOPMENT DRILLING IN RUMANIA - 1950, 1952, 1955 AND 1958

	EXPLORATORY		DEVELOPMENT		TOTAL
YEARS	THOUSAND METERS	PERCENT TOTAL	THOUSAND METERS	PERCENT TOTAL	THOUSAND METERS
1950	225.6	33.6	443.5	66.4	688.1
1952	452.2	46.1	426.8	53.9	980.1
1955	467.2	54.1	396.2	45.9	863.4
1958	378.0	56.8	287.0	43.2	665.0

Use of the turbodrill began in 1952, but this drilling tool has not been given the wide application that it has in the Soviet Union. Currently the turbodrill accounts for 15 percent of all drilling in Rumania, but by 1965 is to account for 70 percent of all drilling.

B. Natural Gas Production and Consumption

The production of natural gas in Rumania provides about one-third of the annual energy availability in that country. If the plan for production of natural gas in 1965--13.3 billion cubic meters--is met, in terms of standard fuel, the natural gas supply will approximately equal the indigenous crude oil supply.

Steady increases in production of natural gas have been maintained since 1950, from 3,242 million cubic meters in that year to 10,700 million cubic meters in 1961.

Natural gas is widely used as a fuel in the generation of electric power, by the chemical industry and in cooking and heating. In 1958 more than 40 percent of the electric power generated in Rumania was produced by thermal power plants using natural gas as a fuel. In the manufacture of carbon black, acids, fertilizers, plastics and acetylene the chemical industry consumes about 14 percent of the annual output of natural gas.

To transport the natural gas from the producing areas to industrial and household consumers, Rumania, compared with most of the countries of the Sino-Soviet bloc, has installed a sizeable distribution system. Most of the installation of natural gas pipeline in Rumania has taken place since 1950.

With the commissioning of a 365 kilometer gas pipeline in 1959, which terminates in Hungary, the export of natural gas from Rumania began. In 1959, this pipeline delivered 147.3 million cubic meters of natural gas to Hungary for use in the matallurgical industry and for consumption in the generation of electric power. Exports increased in 1960 to 203.7 million cubic meters.

C. Refining

Before World War II, primary distillation capacity in Rumania reached about 9 million tons and cracking capacity about 2 million tons. Current refinery capacity is estimated

TABLE 11-6

PRODUCTION OF NATURAL GAS IN RUMANIA - 1950-1961 AND 1965 PLAN (Million Cubic Meters)

YEAR	NON-ASSOCIATED (AMOUNT)	GROSS ASSOCIATED (AMOUNT)	TOTAL (AMOUNT)
1950	1,949	1,293	3,242
1951	2,558	1,485	4,043
1952	2,973	1,378	4,351
1953	3,475	2,119	5,594
1954	3,629	2,197	5,826
1955	3,972	2,197	6,169
1956	4,373	2,383	6,756
1957	4,633		
1958	5,075	3,238	8,313
1959	5,782	3,523	9,305
1960	6,519	3,623	10,142
1961	NA	NA	10,700
1965 Plan	NA	NA	13,300

TABLE 11-7

NATURAL GAS TRANSMISSION SYSTEM OF RUMANIA FOR SELECTED YEARS 1938-1960

YEAR	KILOMETERS
1938	179
1943	326
1948	776
1955	1,876
1960 Plan	4,076

to be about 11.8 million tons, an increase of about 3 million tons compared with the pre-war level. Cracking capacity has increased by approximately 1.1 million tons, to slightly more than 3 million tons capacity available at the present time. Catalytic cracking capacity is rated at about 500,000 tons. The only catalytic reforming unit in Rumania, located at Brazi, was placed in operation in 1961. 4/

The yield of refined petroleum products in Rumania has remained almost constant in recent years. The yield in 1960 represented about a 7 percent growth compared with the yield in 1955 and the yield planned for 1965 is to represent an increase of less than 6 percent, compared with 1960.

TABLE 11-8

YIELDS OF REFINED PRODUCTS IN RUMANIA
1955, 1958-1960 AND 1965 PLAN
(Thousand Metric Tons)

PRODUCT	1955 a/	1958 a/	1959 b/	1960 b/	1965 PLAN
Gasoline	2,635	2,821	2,698	2,792	2,370 c/
Kerosine	1,362	1,529	1,279	1,289	1,180 c/
Diesel Fuel	1,626	1,807	2,277	2,376	3,490 c/
Lube Oils	162	212	271	311	330 c/
Residual and Others*	4,340	4,250	4,270	4,073	4,098 d/
TOTAL	10,125	10,619	10,795	10,841	11,468

* Includes fuel oil, wax and greases.
a/ 5/
b/ 6/
c/ 7/
d/ Estimate.

D. Exports

As illustrated by Table 11-3, exports of petroleum from Rumania have increased from 5.85 million tons in 1956 to 6.35 million tons in 1961. Within this growth, shipments of petroleum to the Free World have increased from 1.4 million tons in 1956 to about 3 million tons in 1961.

Table 11-9 shows average rate of tanker shipments leaving Constanta (as last Black Sea port) through the Bosporus, by country of destination port. Since the table was prepared from Bosporus traffic data, the volumes shown do not necessarily represent purchases by the indicated countries, but probably record only the location of the first destination port after leaving the Black Sea. As shown in Table 11-9 and in Table 11-10, which breaks down by type of product total sales of Rumanian petroleum for 1958-60, Rumania exports only products, primarily gasoline and diesel fuel. This pattern holds true not only for the Free World but for all other purchasers as well.

TABLE 11-9

ESTIMATED SHIPMENTS OF PETROLEUM FROM RUMANIA TO THE FREE WORLD BY COUNTRY OF DESTINATION PORT AND BY TYPE OF PRODUCTS a/
1961
(Barrels Per Day)

COUNTRY OF DESTINATION PORT b/	GASOLINE	KEROSINE	DISTILLATES	RESIDUALS	OTHERS	TOTAL PRODUCTS	CRUDE OIL	TOTAL CRUDE AND PRODUCTS
Brazil	402	0	408	0	0	810	0	810
Cuba	475	0	386	0	0	861	0	861
United States	285 c/	0	0	0	0	285	0	285 c/
Uruguay	0	0	0	0	0	0	0	0
SUB-TOTAL	1,162	0	794	0	0	1,956	0	1,956
Belgium	1,240	333	1,404	0	0	2,977	0	2,977
Denmark	0	0	0	0	0	0	0	0
Finland	1,793	278	2,974	0	0	5,045	0	5,045
France	3,404	762	2,181	0	0	6,347	0	6,347
Greece	829	756	1,638	339	11	3,573	0	3,573
West Germany	715	0	342	0	0	1,057	0	1,057
Iceland	0	0	0	0	0	0	0	0
Italy	2,696	930	3,809	0	0	7,435	0	7,435
Netherlands	6,176	696	8,986	0	0	15,858	0	15,858
Norway	1,027	0	604	0	0	1,631	0	1,631
Spain	570	384	1,098	0	0	2,052	0	2,052
Sweden	1,659	378	1,301	0	0	3,338	0	3,338
Turkey	0	0	0	0	0	0	0	0
United Kingdom	0	0	0	0	0	0	0	0
Yugoslavia	0	0	0	0	0	0	0	0
SUB-TOTAL	20,109	4,517	24,337	339	11	49,313	0	49,313
Egypt	1,374	1,536	3,922	0	0	6,832	0	6,832
Lebanon	0	0	0	0	0	0	0	0
Syria	418	0	695	0	0	1,113	0	1,113
Israel	0	0	0	0	0	0	0	0
Tunisia	0	0	0	0	0	0	0	0
Algeria	0	0	0	0	0	0	0	0
Morocco	351	0	0	0	0	351	0	351
Guinea	0	0	0	0	0	0	0	0
SUB-TOTAL	2,143	1,536	4,617	0	0	8,296	0	8,296
Burma	0	0	0	0	0	0	0	0
India	0	0	0	0	0	0	0	0
Japan	398	0	393	0	0	791	0	791
SUB-TOTAL	398	0	393	0	0	791	0	791
Other	402	292	357	0	0	1,051	0	1,051
TOTAL FREE WORLD	24,214	6,345	30,498	339	11	61,407	0	61,407

a/ Based upon January 1 - November 30, 1961 tanker movements through the Bosporus. May include certain quantities exported on Soviet account.
b/ In some cases, in particular the Netherlands, not the ultimate destination.
c/ Benzol.

TABLE 11-10

EXPORTS OF PETROLEUM PRODUCTS
FROM RUMANIA, BY TYPE - 1958-60
(Thousand Metric Tons)

TYPE OF PRODUCT	1958 a/	1959 b/	1960 b/
Gasoline	2,258.0	2,566.5	2,465.8
Kerosine	716.0	697.6	675.7
Diesel Fuel	1,479.0	1,390.9	1,286.3
Fuel Oil	552.0	985.7	1,229.4
Lubricants	.0	155.2	211.4
Bitumen	58.9	62.3	81.2
Petroleum Coke	.0	16.3	13.7
TOTAL	5,063.9	5,874.5	5,963.5

a/ 8/
b/ 9/

SECTION 38

OTHER ENERGY OF RUMANIA

A. Coal

The production of coal in Rumania has more than doubled during the years 1950-61, to about 8.7 million tons, with lignite providing the greater share of the increase. Within this period the share of lignite in the total national output of coal increased from 20.8 percent to 40.7 percent (1959), the increase having been made at the expense of hard coal, as illustrated in Table 11-11.

The production of coal is to increase further to 11.5-12.5 million tons by 1965. Of this quantity planned, about 6 million tons is to be hard coal, largely to meet coke requirements.

TABLE 11-11

PRODUCTION OF COAL IN RUMANIA
BY TYPE - SELECTED YEARS 1950-1961
(Thousand Metric Tons)

TYPE OF COAL	1951	1955	1956	1957	1958	1959	1960	1961
Hard Coal	2,717	3,334	3,447	3,618	3,898	4,148	4,481	4,700
Brown Coal	349	458	487	521	534	549)		
Lignite	810	2,293	2,527	2,898	2,948	3,280)	3,682	4,000
Anthracite	16	19	11	17	7	0	0	0
TOTAL	3,892	6,104	6,472	7,054	7,387	7,977	8,163	8,700

The distribution of production of coal among the various types does not yet reflect the status of the coal reserves. According to the latest estimates, brown coal represents 70.3 percent of the coal reserves, lignite represents 27.9 percent, and hard coal and anthracite the remainder.

The major coal producing areas within Rumania are the Jiu Valley and Muntenia basins which in 1957 accounted for 73 percent of the national output. The rapid growth in recent years of the production of lignite at Muntenia has decreased the relative share of output from the Jiu Valley basin. The share of the latter basin in the total national output has declined from 66.4 percent in 1950 to 50.3 percent in 1957. Concomitantly, the share of Muntenia has increased from 10.9 percent to 22.7 percent.

Certain changes have been made in the past ten years in the pattern of consumption of coal within Rumania. Coal as a fuel for industry (excluding electric power stations) and for transport has been replaced to a considerable degree by liquid and gaseous fuels. On the other hand, the consumption of coal in the generation of electric power has significantly increased. It is estimated that almost one-third of the coal consumed in Rumania in 1960 was in the generation of electric power. The growth in industry and the concomitant increase in demand for metallurgical coke has required increasingly larger quantities of coal for use in the production of coke.

TABLE 11-12

DISTRIBUTION OF PRODUCTION OF COAL IN RUMANIA, BY BASIN - 1950 AND 1957
(Percent Of Total)

BASIN	1950	1957
Jiu Valley	66.4	50.3
Ardeal	12.1	21.2
Muntenia	10.9	22.7
Banat	6.2	3.1
Moldova	4.4	2.7
TOTAL	100.0	100.0

TABLE 11-13

CONSUMPTION OF COAL IN RUMANIA, BY CONSUMER - 1950, 1955 AND 1960 (Percent Of Total)

CONSUMER	1950	1955	1960
For Coke	3	5	19
Electric Power	6	25	32
Industry	41	28	15
Transport	48	35	21
Everyday Needs	2	7	13
TOTAL	100	100	100

B. Hydroelectric and Electric Power

As a share of total national output, that amount of electric power generated by hydrostations in Rumania in general has been declining since 1950, although some recovery was made in 1960-61. Rumania apparently has no plans at present to take advantage of the hydroelectric power potential of the country, which is termed the highest of any of the European Satellite nations.

TABLE 11-14

GENERATION OF ELECTRIC POWER IN RUMANIA - SELECTED YEARS 1950-1961

YEAR	TOTAL (MILLION KILOWATT-HOURS)	OF WHICH, HYDROPOWER (MILLION KILOWATT-HOURS)	OF WHICH, HYDROPOWER PERCENT OF TOTAL
1950	2,113	169	8.0
1955	4,340	323	7.4
1956	4,930	287	5.8
1957	5,440	300	5.5
1958	6,184	281	4.5
1959	6,824	298	4.4
1960	7,650	397	5.2
1961	8,800	465	5.3

Prior to 1950, installed generating capacity at hydropower stations totalled only 60-megawatts or less than 8 percent of all generating capacity in the country. During 1951-55, an additional 40-megawatts were installed, to increase hydropower station capacity to 100-megawatts. Further increases in installed capacity were attained during 1956-60, to an estimated 225-megawatts, which represents 12.7 percent of total installed capacity.

Industry is the major consumer of electric power in Rumania. Little change in the pattern of consumption of electric power has taken place during the period 1950-57, as Table 11-15 shows.

TABLE 11-15

CONSUMPTION OF ELECTRIC POWER IN RUMANIA, BY CONSUMER - 1950 AND 1957 (Percent Of Total)

CONSUMER	1950	1957
Industry	64.5	64.2
Communal Economy	15.3	14.7
Transport	1.5	1.2
Agriculture	0.8	1.2
Export	1.0	0.3
Consumption By Generation Stations	6.6	7.3
Losses in the System	10.3	11.1
TOTAL	100.0	100.0

PART FIVE

COMMUNIST CHINA AND MONGOLIA

CHAPTER XII

SUMMARY - COMMUNIST CHINA

CHAPTER XII *

SUMMARY - COMMUNIST CHINA

The economy of Communist China is based on coal so far as primary energy is concerned. The preponderance of coal-producing areas in China is portrayed graphically by Map No. 23. Although the data are very meager, those which are presented in Table 12-1 probably represent a fairly reasonable breakdown of the production of primary energy in Communist China for the years 1957 and 1960.

The so-called "leap-forward" program of Communist China has brought about a striking increase in the consumption of energy--from an estimated 107 million tons of standard fuel in 1957 to 339.6 million tons in 1960, more than a threefold increase. With the exception of petroleum, the production of the various forms of energy also is representative of the consumption. The apparent consumption for petroleum in Communist China amounted to 3.26 million tons in 1957 and to 7.96 million tons in 1960, or 160,000 barrels per day. To meet this consumption, it was necessary to import 1.8 million tons in 1957 and 2.96 million tons of crude oil and petroleum products in 1960, or 37 percent of the domestic consumption in that year. These imports were provided primarily by the USSR. It seems probable that a petroleum deficit will prevail for some time and it is estimated elsewhere in this report that imports of petroleum from the USSR in 1965 may reach as much as 5 million tons.

Although Communist China has a large sedimentary basin area--between 670,000 and 850,000 square miles--it has not been able to develop a petroleum producing industry of significance. In 1958 the production of crude oil (natural and synthetic) amounted to 2.25 million tons or about 45,000 barrels per day.

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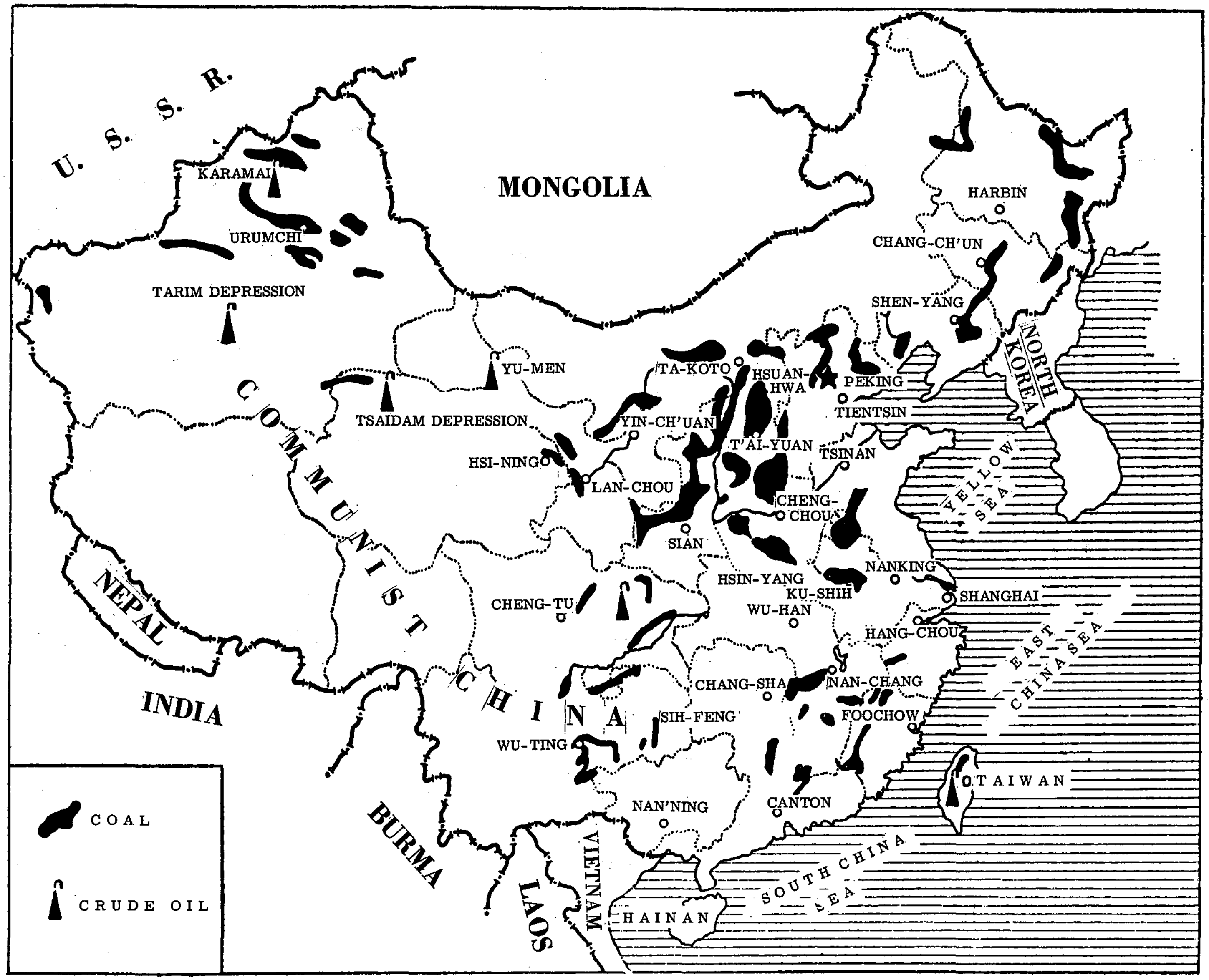
* Except where noted, data for Communist China and Mongolia have been taken from Popov, I.V., Energetika stran narodnoy demokratiy (Energy in the Countries of the Peoples Democracy), Moscow, 1961; Berezina, Yu.I., Toplivno-energeticheskaya baza KNR (Fuels-Energy Base of China), Moscow, 1959; and Zabarinskiy, P.P. et al, Neftyanaya i gazovyye mestorozhdeniya Kitayskoy Narodnoy respubliki (Oil and Gas Deposits of China), Moscow, 1958.

Of this amount about 35 percent was produced from shale and synthetically from coal. It is believed that the volume of synthetic oil from coal is quite small. The proportion of natural crude oil has been rising with the acceleration of the crude oil producing program. According to plan, the total production of oil (natural, shale and, synthetics) will reach 5.5 million tons or 110,000 barrels per day in 1962. To effect these increases, oil exploration has been rapidly increased.

MAP NO. 23



DISTRIBUTION OF FUELS-ENERGY RESOURCES OF COMMUNIST CHINA

TABLE 12-1

PRODUCTION OF PRIMARY ENERGY
IN COMMUNIST CHINA
1957 AND 1960

SOURCE OF ENERGY	NATURAL UNITS	1957 NATURAL	1957 MMTSF a/	1957 PERCENT OF TOTAL	1960 NATURAL	1960 MMTSF a/	1960 PERCENT OF TOTAL
Coal	Million metric tons	130.7	91.5	87.6	425.0	297.5	88.7
Petroleum	Million metric tons	1.458	2.2	2.1	5.0	7.5	2.2
Natural Gas	Million cubic meters	133.0	0.2	0.2	NA	NA	NA
Hydroelectric Power	Billion kilowatt-hours	19.3	10.6	10.1	55.5	30.5	9.1
TOTAL		-	104.5	100.0	-	335.5 b/	100.0

a/ Following are the conversion factors used in this calculation;
Million Metric Tons of Standard Fuel.
1 metric ton of coal equals 0.7 metric tons of standard fuel.
1 metric ton of petroleum equals 1.5 metric tons of standard fuel.
1,000 cubic meters of natural gas equals 1.2 metric tons of standard fuel.
1,000 kilowatt-hours of hydroelectric power equals 0.55 metric tons of standard fuel.

b/ Excluding natural gas.

CHAPTER XIII

PETROLEUM - COMMUNIST CHINA

CHAPTER XIII

PETROLEUM - COMMUNIST CHINA

SECTION 39

EXPLORATION OF PETROLEUM

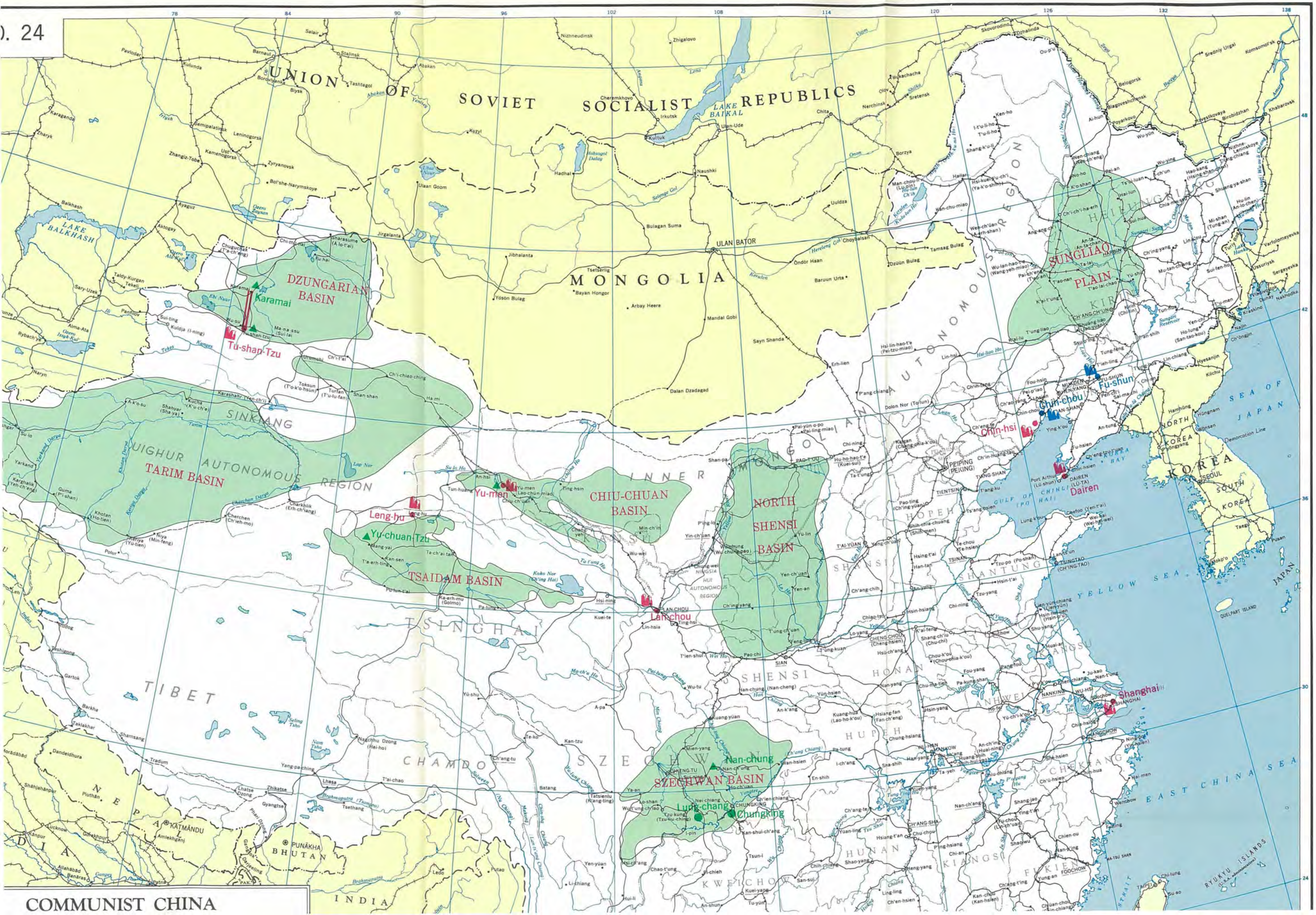
The sedimentary area in China is estimated at 670,000-850,000 square miles and, as shown on Map No. 24, is found principally in seven major sedimentary basins. These are the Dzungarian Basin, the Tarim Basin, the Tsaidam Basin, the Chiu-Chuan Basin, the North Shensi Basin, the Szechwan Basin and the Sungliao Plain. In 1950 there was little exploration activity, only 17 parties were in the field. By 1957 this had been increased considerably to 246 parties, although the overall level might still be considered quite low. Later data are not available.

NUMBER OF EXPLORATORY PARTIES
IN COMMUNIST CHINA a/
1950, 1952 AND 1957

TYPE OF PARTY	1950	1952	1957
Geological	8	NA	NA
Geophysical	2	14	NA
Topo-geodetic	7	NA	NA
	17	59	246*

* Excluding prospecting-exploratory parties of the Ministry of Geology.

a/ 1/



). 24
COMMUNIST CHINA
UNION OF SOVIET SOCIALIST REPUBLICS
MONGOLIA
INNER MONGOLIAN AUTONOMOUS REGION
SINKIANG UIGHUR AUTONOMOUS REGION
TSINGHAI
TIBET
CHAMDO
SZECHWAN
KANSU
NINGSIA HUI AUTONOMOUS REGION
SHENSI
SHANSI
HOPEH
SHANTUNG
HONAN
HUPEH
HUNAN
KWEICHOW
KIANGSI
ANHWEI
KIANGSU
CHEKIANG
FUKIEN
HEILUNGKIANG
KIRIN
KOREA
NORTH KOREA
SOUTH KOREA
JAPAN
NEPAL
BHUTAN
INDIA
DZUNGARIAN BASIN
TARIM BASIN
TSAIDAM BASIN
CHIU-CHUAN BASIN
NORTH SHENSI BASIN
SZECHWAN BASIN
SUNGLIAO PLAIN
Karamai
Tu-shan-Tzu
Yu-men
Leng-hu
Yu-chuan-Tzu
Lan-chou
Nan-chung
Lung-chang
Chungking
Fu-shun
Chin-chou
Chin-hsi
Dairen
Shanghai
LAKE BALKHASH
LAKE BAIKAL
ULAN BATOR
PEIPING (PEKING)
TIENTSIN
SIAN
NANKING
HARBIN
LHASA
KATMANDU
PUNAKHA
SEOUL
SEA OF JAPAN
YELLOW SEA
EAST CHINA SEA
GULF OF CHIHLI (PO HAI)
KOREA BAY
RYUKYU ISLANDS
QUELPART ISLAND

ational Petroleum Council, 1962
. C.

TABLE 13-2

NUMBER OF GEOPHYSICAL PARTIES
IN THE PETROLEUM INDUSTRY
OF COMMUNIST CHINA a/
1950-56

YEAR	GRAVIMETRIC	MAGNETIC	ELECTRIC	SEISMIC	THEMATIC	TOTAL
1950	2	-	-	-	-	2
1951	4	1	1	1	6	13
1952	6	1	2	5	-	14
1953	12	12	3	7	1	35
1954	21	21	5	10	9	66
1955	28	26	8	13	8	83
1956	25	24	15	21	11	96

a/ 2/

Electric well-logging was first used in 1940, at the Lao-Chun-Miao deposit; nevertheless, up to 1949, there was only one logging-perforation crew in the field. By 1958, there were 48 crews at work at various locales within the country. Use of radioactive well-logging was first instituted in 1956, as was gas well-logging.

During 1950-57 there were discovered in China 11 crude oil and 3 gas deposits. By the end of 1959 there were a total of 32 crude oil and 18 gas deposits. Of the present total of 50 deposits, 32 were discovered during 1958-59.

SECTION 40

DRILLING FOR PETROLEUM

During 1949-59 the total volume of drilling in the petroleum industry of China reached to more than 5 million meters. Primary emphasis during these years was given to exploratory drilling. Comparatively equal volumes were devoted to structural-core drilling and to drilling for the development of production from deposits already delineated by exploratory drilling.

In 1956, the last year for which data are available, Communist China was able to field 132 drilling crews. These crews carried out drilling operations at 23 separate areas, each crew averaging about 3,000 meters of drilling in that year. Also in the field in that year were 51 structural drilling crews, each averaging about 2,000 meters of drilling for the year.

Data on drilling in Communist China for selected years during the period 1950-58 is given in the following table.

TABLE 13-3

DRILLING IN THE PETROLEUM INDUSTRY OF COMMUNIST CHINA a/
SELECTED YEARS, 1950-58

INDICATOR	1950	1953	1954	1955	1956	1958
Structural-Core Drilling (Thousand Meters)	-	17.3	25.2	49.3	109.0	-
Total Deep Drilling (Thousand Meters)	6.9	90.3	130.0	194.7	404.5	1,176
Including:						
Exploratory	4.2	69.3	83.3	134.6	243.9	803
Development	2.7	21.0	46.5	60.1	160.6	378
Exploratory Drilling Speed (Meters/Rig-Month)	104.0	153.0	172.0	254.0	304.0	543
Development Drilling Speed (Meters/Rig-Month)	301.0	155.0	319.0	300.0	541.0	1,386
Average Drilling Depth (Meters)	-	475.0	508.0	793.0	795.0	1,055
Maximum Drilling Depth (Meters)	900.0	2,100.0	NA	NA	NA	more than 3,200

a/ 1/

SECTION 41

PRODUCTION OF PETROLEUM

A. Crude Oil

There are two sources of crude oil in Communist China: natural and that derived from coal and shale. The thermal refining of coal and oil shale has for a number of years been a significant source of crude oil but currently natural crude provides the larger share.

TABLE 13-4

ESTIMATED PRODUCTION OF CRUDE OIL
IN COMMUNIST CHINA
1949-62 AND 1965 COMMITTEE ESTIMATE

	THOUSAND METRIC TONS				
YEAR	NATURAL	PERCENT OF TOTAL	SYNTHETIC	PERCENT OF TOTAL	TOTAL
1949 a/	70	57.9	51	42.1	121
1950 b/	NA	-	NA	-	202
1951 b/	NA	-	NA	-	305
1952 a/	195	44.8	240	55.2	435
1953 a/	306	49.2	316	50.8	622
1954 a/	382	48.4	407	51.6	789
1955 a/	423	43.8	543	56.2	966
1956 a/	589	50.6	574	49.4	1,163
1957 a/	861	59.1	597	40.9	1,458
1958 a/	1,464	65.2	781	34.8	2,245
1959-Plan	NA				3,500 c/
-Actual	NA		NA		3,700 d/
1960-Plan	NA		NA		5,200 e/
-Actual	NA		NA		5,000 f/
1961-Plan	NA		NA		NA
-Estimate	NA		NA		5,250
1962-Plan	NA		NA		5,500
Karamai Fields	3,000				
Yu-men	1,600				
Other	900				
1965 Committee Estimate					6,900

a/ 1/ c/ 3/ e/ 5/
b/ 2/ d/ 4/ f/ Committee estimate.

In the 1953-58 period the Yu-men fields were the major natural crude producing fields. In 1958 commercial production was begun at the highly promising Karamai fields. The percentages of the natural crude production furnished by these two fields were as follows:

PERCENT OF TOTAL NATIONAL PRODUCTION

YEAR	YU-MEN	KARAMAI
1953	76	-
1955	91	-
1957	90	-
1958	72	24

An increase in the extraction of natural crude oil in Communist China depends to a great degree upon the drilling of shallow wells, to tap productive strata lying near the surface of the earth. The total area of shallow-lying deposits is calculated at 1,000 square kilometers. In the Karamai region, where exploitation of shallow strata was first begun, these deposits occupy an area of about 200 square kilometers. Earlier it had been considered that the exploitation of such deposits was not effective and not economical, thus attention had been turned to the exploration and development of large deeper deposits.

The production of synthetic crude oil is concentrated in northeast China, in the former Manchuria area, although the deposits of coal and shale are distributed throughout the country.

The reserves of those coals which lend themselves most readily to thermal processing are estimated at 43 billion tons (1956), and the proved reserves of fuel shales are estimated at more than 18 billion tons, or the equivalent of about 700 million tons of shale tars.

In 1929 the first shale oil plant at Fushun was completed, and beginning with the next year, an annual output of up to 73,000 tons of raw oil was obtained. From the 73,000 tons of raw oil there was obtained 55,000 tons of synthetic crude oil, 13 thousand tons of paraffin and 5,000 tons of coke.

The Fu-shun plant No.1 suffered some damage during the war but in 1949, a total of 51,000 tons of synthetic crude oil were produced at its facilities. These installations now have a total annual capacity of 500,000 tons. In 1958 in southern China in the Province of Kwangtung, construction was begun of facilities for the processing of fuel shales from local deposits. Upon completion, this plant is to have an annual capacity of 1 million tons per year.

As a part of the so-called "leap-forward" program, Communist China planned to construct a large number of small plants for the production of synthetic liquid fuels. A number of these enterprises were built but their small capacity, coupled with an apparent lack of operational experience, has made the program extremely inefficient and a rather undependable source of fuel.

B. Natural Gas

Only minor amounts of natural gas are produced in Communist China. Probably the most conspicuous use of this fuel has been as a substitute fuel for carburetor engines, particularly buses, at a time when liquid fuels were in short supply. In particular, buses were fueled by natural gas drawn from large bags resting on the roof of the vehicle. The reported production of natural gas to Communist China during the years 1953-58 is given in the following table.

TABLE 13-5

PRODUCTION OF NATURAL GAS
IN COMMUNIST CHINA
1953-58

YEAR		AMOUNT (THOUSAND CUBIC METERS)
1953		41,552
1954		54,909
1955		64,611
1956		72,744
1957		133,458
1958-Associated	106,000	
-Non-Associated	85,000	191,000

SECTION 42

REFINING OF PETROLEUM

In 1961 the annual refining capacity in Communist China totalled 5,500,000 tons, of which 800,000 tons or 14.5 percent were synthetic plants and 4,700,000 tons or 85.5 percent were natural crude refineries. Annual capacities of the individual shale oil and synthetic plants and of the natural crude oil refineries in China for 1961 are given in Table 13-6. Considerable effort has been exerted in recent years in the construction of new refining capacity. The first units of a new crude oil refinery at Lan-chou went on stream in 1958. Construction of the second phase is now under way. Completed in the first phase were a cat cracker for producing high octane aviation gasoline, a propane deasphalting unit and facilities for the processing of natural gas. This refinery is being built primarily with Soviet aid; 85 percent of the material and equipment used in the first stage of construction was supplied by the Soviet Union. Current charge capacity of the Lan-chou refinery is 1 million tons per year (20,000 B/D). When this refinery is completed it will have a charge of 5 million tons per year (100,000 B/D) and will refine crude oil from Karamai, the Tsaidam basin, Yu-men, and Tu-shan-tzu in Sinkiang. Crude is delivered to the refinery by rail and truck, and tentative plans call for linking the refinery to the oil fields by means of pipelines.

At the beginning of 1959, construction was completed on a 10,000 barrel-per-day refinery at Yu-men. Other refineries in Communist China which process natural crude oil are located at Shanghai, Dairen, Tu-shan-tzu, Leng-hu, and Chin-hsi. Of these, the largest is the Tu-shan-tzu or Sinkiang refinery, which has a capacity of 1 million tons per year. Next in size is the Yu-men refinery, with a capacity of 800,000 tons per year (16,000 B/D).

In addition to facilities for the processing of natural crude oil, Communist China has available a limited capability for the output of petroleum products by shale oil and coal hydrogenation plants. This capacity represents an estimated 14.5 percent of total refinery capacity in Communist China.

TABLE 13-6

ANNUAL CAPACITIES OF REFINING FACILITIES IN COMMUNIST CHINA 1961

	ANNUAL CAPACITY (THOUSAND METRIC TONS)	PERCENT OF TOTAL
FACILITIES AT SHALE OIL AND SYNTHETIC PLANTS		
Refinery No. 1, Fu-shun (shale oil plant)	400	7.3
Refinery No. 3, Fu-shun	100	1.8
Refinery No. 6, Chin-chou (Fischer-Tropsch)	100	1.8
Maoming Shale Oil Plant	100	1.8
Unlocated (numerous small plants)	100	1.8
SUB-TOTAL	800	14.5
NATURAL CRUDE OIL REFINERIES		
Tu-shan-tzu (Sinkiang)	1,000	18.2
Lan-chou	1,000	18.2
Yu-men	800	14.5
Dairen (Refinery No. 7)	750	13.6
Shanghai	500	9.1
Leng-hu	300	5.5
Chin-hsi (Refinery No. 5)	250	4.5
Other (several small refineries)	100	1.8
SUB-TOTAL	4,700	85.5
TOTAL CAPACITY a/	5,500	100.0

a/ 1/

SECTION 43

PETROLEUM TRANSPORT

Most of the movement of petroleum in Communist China is handled by rail. The only two oil pipelines now in use in China, the first constructed during 1958 and the second in the following year, carry crude oil from the Karamai fields to the oil refinery at Tu-shan-tzu. These pipelines, each 150 kilometers in length, can move about 800 thousand tons per year. The lack of adequate transport facilities has proved to be a major handicap to the efficient development of the petroleum industry.

SECTION 44

DEMAND FOR PETROLEUM

The petroleum supply/demand situation for Communist China is shown in the following table.

TABLE 13-7

APPARENT DEMAND FOR PETROLEUM IN COMMUNIST CHINA 1955-60

	THOUSAND METRIC TONS					
SUPPLY	1955	1956	1957	1958	1959	1960
Production	966.0	1,163.0	1,458.0	2,245.0	3,700.0	5,000.0
Imports*	1,589.2	1,732.3	1,802.7	2,507.2	3,048.2	2,962.8
TOTAL	2,555.2	2,895.3	3,260.7	4,752.2	6,748.2	7,962.8
DEMAND						
Exports	.0	.0	.0	.0	.0	.0
Apparent Consumption	2,555.2	2,895.3	3,260.7	4,752.2	6,748.2	7,962.8
TOTAL	2,555.2	2,895.3	3,260.7	4,752.2	6,748.2	7,962.8

* From the Soviet Union only.[1/] Unknown but insignificant quantities are imported from Albania and Rumania.

Through 1958 more than one-half of the demand for petroleum was supplied by imports. In 1959 and 1960 indigenous production was such as to stabilize imports at about 3 million tons. Nevertheless, it is probable that the situation is temporary and that imports will gradually increase at least through 1965. In that year it is probable that such imports will reach 5 million tons, and that these imports will be almost wholly from the Soviet Union.

CHAPTER XIV

COAL - COMMUNIST CHINA

CHAPTER XIV

COAL - COMMUNIST CHINA

The major source of primary energy for Communist China is, and has been, coal. At present, coal probably provides almost 88 percent of the energy requirements of the country. In terms of proved reserves of coal, Communist China ranks third in the world, after the USSR and the U.S., with such reserves totalling 170 billion tons in 1958.

TABLE 14-1

PRODUCTION OF COAL IN COMMUNIST CHINA
1940-60

YEAR	MILLION METRIC TONS
1940	46.8
1941	58.8
1942	61.9
1943	53.6
1944	50.5
1945	23.9
1946	18.4
1947	19.5
1948	14.2
1949	32.4
1950	42.0 *
1951	55.0 *
1952	66.5
1953	69.7
1954	83.7
1955	98.3
1956	110.4
1957	130.7
1958	270.2
1959	355.0 *
1960	425.0

* Estimate.

During the first Five-Year Plan in Communist China (1952-57), 11.9 percent of the total capital investment in all industry was assigned to capital construction in the coal industry. By the end of this period, more than one-half (55 percent) of the total capital investment in the coal industry was being diverted to new mines and plants. Nevertheless, the growth in coal production during 1953-57 was based primarily on the expansion and reconstruction of existing mine capacity. In 1957, only 25 percent of the output was provided by new capacity obtained during the first Five-Year Plan.

The larger portion of the annual production of coal in Communist China is directed to meet communal needs. This share --43.5 percent--has remained constant during the years 1952-57. On the other hand, the requirements of industry have increased from 27 percent of the annual production in 1952 to about 38 percent in 1957. Distribution of the consumption of coal in China among the various consumers in 1952 and 1957 is given in the following table.

TABLE 14-2

CONSUMPTION OF COAL IN COMMUNIST CHINA BY SECTOR 1952 AND 1957

	1952		1957	
CONSUMING SECTOR	AMOUNT (MILLION METRIC TONS)	PERCENT OF TOTAL	AMOUNT (MILLION METRIC TONS)	PERCENT OF TOTAL
Industry	15.67	27.0	49.1	37.8
Including:				
Metallurgical	(4.85)	(8.4)	(12.7)	(9.8)
Electric Power Stations	(3.00)	(5.2)	(11.2)	(8.6)
Coal Industry	(1.80)	(3.1)	(4.2)	(3.2)
Transport	6.98	12.0	10.8	8.3
of which, Railroads	(6.70)	(11.6)	(9.8)	(7.5)
Communal Consumers	25.22	43.5	56.5	43.5
Other	10.13	17.5	13.6	10.4
TOTAL	58.00	100.0	130.0	100.00

More than one-half of the annual consumption of coal is concentrated in N.E. China (Mukden and Harbin) and in N. China (Peking and Tyan'tszin). During the second Five-Year Plan (1958-62) the consumption of coal in the South-Central part of China is to increase as the result of construction of the Wu-han metallurgical combine and completion of the Paotou Lan-chou Railroad.

Considerable attention has been given to the construction of so-called small, local mines, designed to supply coal to the local populace, to some industrial enterprises and to meet certain transport needs. These mines, with output of less than 300,000 tons per year each, can be constructed quickly, with comparatively little capital investment and, as the result of being located close to the consumer, offer reduced transportation expenditures. In 1957, the output of coal was distributed as follows:

	MILLION METRIC TONS	PERCENT OF TOTAL
Local Mines	31	23.8
Mines of Coal Industry	93	71.6
Agricultural Co-ops	6	4.6
TOTAL	130	100.0

CHAPTER XV

HYDROELECTRIC POWER - COMMUNIST CHINA

CHAPTER XV

HYDROELECTRIC POWER - COMMUNIST CHINA

In terms of hydroelectric power resources, Communist China ranks first in the world. Hydroelectric resources of the country in 1958 were estimated at 580 million kilowatts, with a technical potential estimated at 2,000 billion kilowatt hours per year. Of the reserves of water energy, more than 72 percent is concentrated in Southwest China and 12.4 percent in Central China.

During the years 1949-59 more than 1.74 million kilowatts of hydroelectric power capacity was commissioned in Communist China; during 1953-57, more than 15 new hydropower stations were built, including Kvan-ting, Shih-tzy-tan, Shantung, Shang-yu-shui, Ku-tien, Liv-chi-ho and others. In addition, the Feng-han hydropower station was increased in capacity from 132.5-megawatts to 568-megawatts.

In 1959-60, construction was begun on about 50 hydropower stations with a total capacity of 9.9 million kilowatts.

TABLE 15-1

TECHNICAL-ECONOMIC INDICES OF SELECTED HYDROPOWER PLANTS BUILT IN COMMUNIST CHINA DURING 1953-57

NAME OF PLANT	RIVER	ANNUAL OUTPUT (MILLION KILOWATT-HOURS)	CAPACITY (MILLION KILOWATT-HOURS)	UNIT COST (YUAN/KILOWATT-HOURS)
Shih-tzu-tan	Lung-chi Ho	206	48	1,525
Shang-yu-shui	Shang-yu-chiang	290	60	955
Kvan-t'ing	Yung-ting Ho	83	30	1,560
Huang-tan-kov	Ch'ang Chiang	145	30	1,590
Ku-t'ien	Ku-t'ien Ch'i	395	62	1,370
Liu-chi Ho	Liu-Chi Ho	158	42	965
Mei-shan	Huai Ho	145	40	420
I-li Ho No. 2	I-li Ho	97	18	635
TOTAL		1,519	330	-

As a result of construction of new hydropower plants during 1953-57 and of the probable fulfillment of plans for new construction during 1959-60, the share of hydroelectric power in the total national generation of electric power is to increase from 25 percent in 1957 to 40 percent in 1962. Data on the output of electric power in Communist China in 1941, 1952-60 and the demand for 1962 are given in the following table.

TABLE 15-2

OUTPUT OF ELECTRIC POWER
IN COMMUNIST CHINA
1941, 1949, 1952-60 AND 1962 DEMAND

YEAR	AMOUNT (BILLION KILOWATT HOURS)	OF WHICH, FROM HYDROSTATIONS (BILLION KILOWATT HOURS)
1941	5.950	NA
1949	4.308	NA
1952	7.261	NA
1953	19.195	NA
1954	11.001	NA
1955	12.278	NA
1956	16.593	NA
1957	19.300	4.82
1958	27.500	NA
1959	41.500	NA
1960	55.500	NA
1962 Demand	74.000	29.60

Little information is available on the consumption of electric power by consuming sector. In 1955, the last year for which data are available, the distribution was as follows:

CONSUMER	PERCENT OF TOTAL	SHARE
Industry and Transport		85.2
Of Which:		
Textiles	14.5	
Fuel Extraction	14.3	
Machine Construction	9.7	
Metallurgy	9.6	
Chemical Industry	8.1	
Paper	5.0	
Food	4.9	
Electric Power Stations Plus Losses in Transmission	15.1	
Other	4.0	
Illumination		12.3
Other		2.5
TOTAL		100.0

CHAPTER XVI

ENERGY IN MONGOLIA

CHAPTER XVI

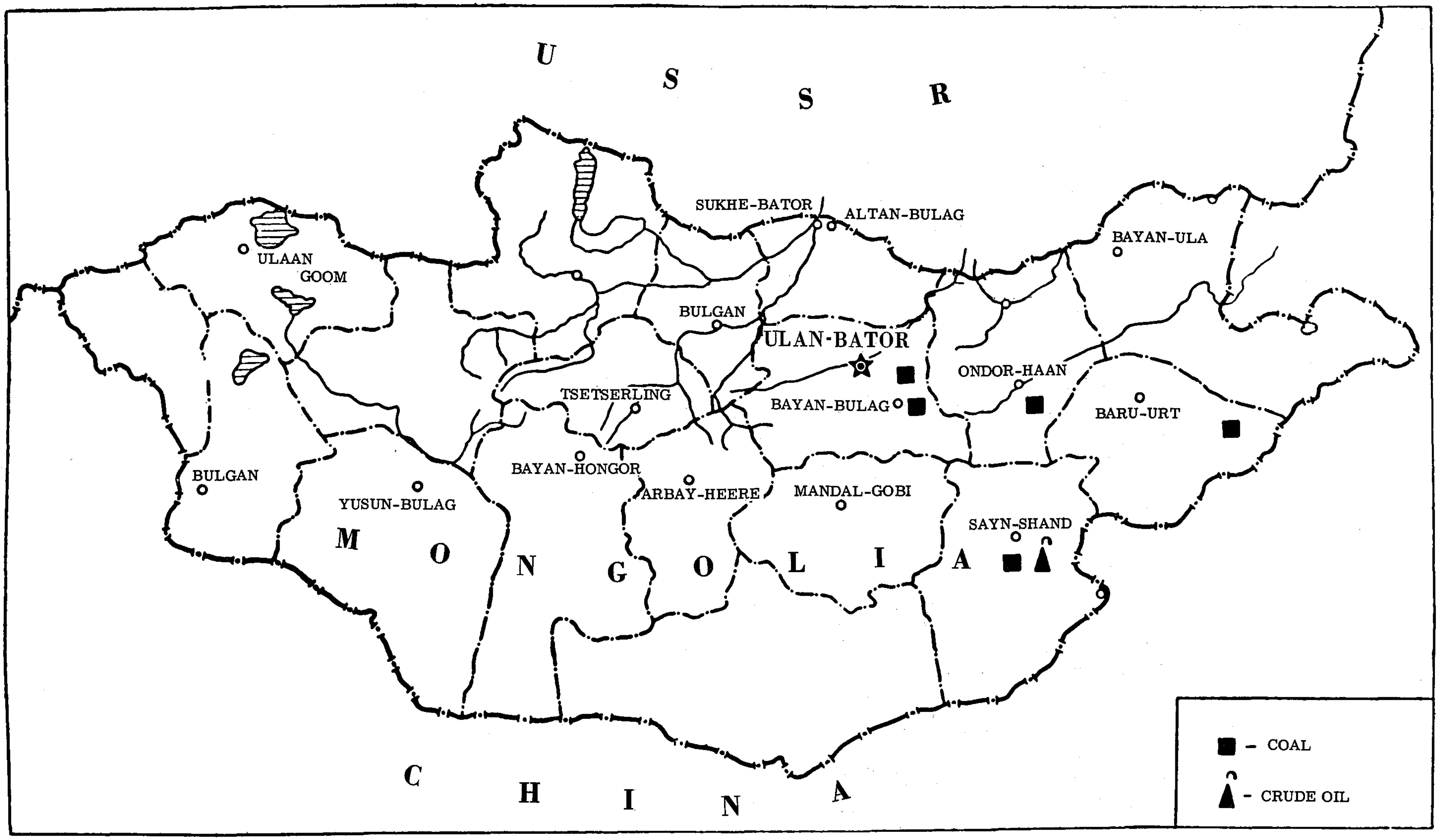
ENERGY IN MONGOLIA

The energy industry of Mongolia is only of passing interest. The production of coal has increased only slightly in recent years, from 209 thousand tons in 1953 to 343 thousand tons in 1956, and to about 400 thousand tons in 1959. The major deposit is the Nalaykhi field.

Only one oil field--Dzunbay--currently is being exploited. The production of crude oil in Mongolia has increased from 27,000 tons in 1958 to 53,000 tons in 1961.1/ The annual production is charged to two refineries and the product yield is sufficient to meet to a large degree the needs of the country.

The geographic distribution of the fuels-energy resources of Mongolia is given on Map No. 25.

MAP NO. 25



DISTRIBUTION OF FUELS-ENERGY RESOURCES OF MONGOLIA

PART SIX

ENERGY AND PETROLEUM PRODUCTION AND CONSUMPTION IN THE SINO-SOVIET BLOC

PART SIX

ENERGY AND PETROLEUM PRODUCTION AND CONSUMPTION IN THE SOVIET BLOC

Table A summarizes the production and consumption of primary energy in the Sino-Soviet bloc in 1960. In this table, Communist China is the only one of the Far East countries of the Bloc which is included, because of incomplete data on the other Far East satellites. The production and consumption of energy in the latter countries is insignificant with respect to the total, however.

Table A underlines the great importance of coal as a source of energy to the Bloc as a whole. Coal provided seventy-one percent of all primary commercial energy produced in the Bloc in 1960, with 19 percent provided by liquid petroleum, 6 percent by natural gas, and 4 percent by hydroelectric power. In spite of the rapid increases expected for production of crude oil and natural gas in the USSR, coal will continue to be the major energy source for the Bloc for many years to come.

Table A shows that the Bloc as a whole exported 4 percent of its primary commercial energy production to the Free World in 1960, the major portion of these exports being petroleum. China and East Europe were net importers of petroleum from the USSR, and East Europe and the USSR were net exporters of coal.

The role of the Soviet Union as an energy producer in the Bloc is less significant than its role as a petroleum producer. Of the total primary energy produced in the Bloc in 1960, 52 percent was supplied by the USSR, with the remainder supplied in roughly equal amounts by China and the European Satellites. Thus, the USSR has an obvious interest in the continued exploitation of the coal and hydroelectric resources of the satellite countries.

From the standpoint of petroleum production, however, the Soviet Union is clearly the preponderant force. Table B summarizes the petroleum supply and demand picture for the Sino-Soviet Bloc in 1956 and presents estimates for 1961 and 1965. It can be seen that total Bloc petroleum production increased from 100.5 million tons in 1956 to an estimated 188.8 million tons in 1961, and the Committee predicts that this total will reach between 295 and 300 million tons by 1965 (including natural gas liquids and synthetics). The great bulk of the petroleum production increase has in the past and will in the future come from the USSR. The USSR provided 83 percent of Bloc petroleum production in 1956, 88 percent in 1961, and is expected to provide 91 percent in 1965. Despite an increasing deficiency of supplies with respect to consumption in the Satellite countries, the Soviet production of crude oil will be adequate not only to meet this deficiency but to permit ever-increasing exports to the Free World. Table B predicts a surplus of 51.0 million tons available for export from the Bloc in 1965. The historical volumes of petroleum exports from the Bloc and possible disposition of future surpluses are discussed in more detail in the Chapter XVIII on Petroleum Trade.

TABLE A

PRODUCTION, CONSUMPTION AND NET EXPORTS OF ENERGY IN THE SINO-SOVIET BLOC 1960* a/
(Million Metric Tons of Standard Fuel)

	PRODUCTION	CONSUMPTION	NET EXPORT
COAL			
USSR	373.1	365.7	7.4
East Europe	238.6	229.7	8.9
China b/	297.5	297.5	-
Total Bloc	909.2	892.9	16.3
Percent of Total Energy Produced	71		
LIQUID PETROLEUM			
USSR	211.5	170.0	41.5
East Europe	20.7	22.7	(2.0)
China b/	7.5	11.7	(4.2)
Total Bloc	239.7	204.4	35.3
Percent of Total Energy Produced	19		
NATURAL GAS			
USSR	54.4	54.2	0.2
East Europe	16.8	17.0	(0.2)
China b/	neg.	neg.	-
Total Bloc	71.2 c/	71.2	0
Percent of Total Energy Produced	6		
HYDRO			
USSR	23.9	23.9	-
East Europe	2.9	2.9	-
China b/	30.5	30.5	-
Total Bloc	57.3	57.3	-
Percent of Total Energy Produced	4		
TOTAL ENERGY			
USSR	662.9	613.8	49.1
East Europe	279.0	272.3	6.7
China	335.5	339.7	(4.2)
Total Bloc	1,277.4	1,225.8	51.6

* Derived from appropriate sections in this report.

a/ Excludes wood, peat and shale with the exception of China where shale liquids are included as liquid petroleum.

b/ Other Asian nations in the Bloc are not included because of lack of complete data.

TABLE B

PRODUCTION AND CONSUMPTION OF
PETROLEUM IN THE SINO-SOVIET BLOC
1956 AND COMMITTEE ESTIMATES FOR 1961 AND 1965* a/
(Million Metric Tons)

	1956		1961 COMMITTEE ESTIMATE		1965 COMMITTEE ESTIMATE	
	Production	Consumption	Production	Consumption	Production	Consumption
USSR	84.0	79.0	166.0	130.0	270.0	200.0
EAST EUROPE						
Albania	0.3	0.1	0.8	0.4	1.1	0.7
Bulgaria	0.2	0.5	0.2	1.2	0.3	1.8
Czechoslovakia	0.4	1.6	0.5	3.3	0.6	6.1
East Germany	2.0	2.0	2.0	3.4	2.0	5.0
Hungary	1.3	1.6	1.5	2.8	1.8	4.6
Poland	0.2	1.7	0.2	3.0	0.3	4.9
Rumania	10.9	5.0	11.6	5.3	12.5	7.7
Total East Europe	15.3	12.5	16.8	19.4	18.6	30.8
CHINA AND FAR EAST	1.2	2.9	5.3	8.8	7.0	13.8
TOTAL	100.5	94.4	188.1	158.2	295.6	244.6
NET EXPORTS FROM BLOC b/		6.1		29.9		51.0 c/

* Derived from data in other sections of this Report.
a/ Including natural gas liquids and synthetics, except for USSR in 1956 and 1961.
b/ Equivalent to total exports less imports from Free World.
c/ Represents an estimated surplus available for export from the Bloc if Free World markets are found.

PART SEVEN

SINO-SOVIET BLOCK TRADE WITH THE FREE WORLD

CHAPTER XVII

TOTAL TRADE

CHAPTER XVII

TOTAL TRADE

SECTION 45

HISTORICAL

Among the first things to be nationalized when the Communists came to power in Russia was foreign trade. A government decree of April 23, 1918, prohibited all import and export transactions except through the intermediary of special state agencies. Later a single Commissariat of Foreign Trade was established to plan, regulate and control foreign trade. This agency, now known as the Ministry of Foreign Trade, uses trading corporations or missions in different countries through which it buys and sells in Free World markets.

While there have been some changes in form through the years, the principle of maintaining a state monopoly over exports and imports has never been infringed. Even during the period of the New Economic Policy in the early 1920's, when the Communists relaxed some controls over certain sectors of the Soviet economy, foreign trade continued to be rigidly controlled.

The USSR considered it essential that foreign trade be monopolized in order to make it entirely subordinate to the aims of the country's national economic plans. Aside from this, however, it was recognized that complete control over foreign trade had other purposes. Such control provides:

(a) Complete protection of the domestic economy against foreign competition.

(b) Isolation of the internal currency from the influence of foreign exchange markets.

(c) A strong bargaining position in trading with free enterprise countries.

(d) Ability to discriminate among purchasers and suppliers and to sell in foreign markets without regard for normal commercial considerations or internal costs.

(e) Flexibility to adjust trade to serve political objectives.

Premier Khrushchev underscored the importance of the last purpose when he stated that "We value trade least for economic reasons and most for political purposes." Clearly Soviet Bloc trade, which is backed by the monolithic power of the State, cannot be considered on the same terms as the trade of individual private companies motivated by commercial objectives. The foreign trade of the Soviet Bloc is but one element in the Soviet Union's plan to consolidate its own power and to extend Communistic influence over countries that deal with it.

Specifically, the foreign trade and aid program of the Soviet Bloc is aimed at:

(a) Obtaining vital strategic materials and technical know-how from the Free World to strengthen the Communist economic-military base.

(b) Spreading Communism through extension of state control in countries with whom they trade, thus expanding their area of immediate ideological influence and eventual control.

(c) Destroying operations of private companies. The USSR recognizes that large commercial firms, particularly the international oil companies, are not only a source of strength to the Free World, but pose a threat to extension of their own ideology of state control.

(d) Creating unrest and political instability in areas of vital importance to the defenses of the Free World.

The collapse of the Russian economy, and the Communist Revolution in 1917, were accompanied by a sharp reduction in Russian foreign trade from pre-World War I volumes. In the early years of the Soviet Union her foreign trade was aimed at obtaining assistance in the rapid industrialization which the

Soviet leaders felt so important. An all-out effort was made to export in order to pay for the imports of capital goods and technology even though it meant depriving the Soviet people of many of the necessities for human comfort. By 1930 the volume of trade had regained 50 to 70 percent of the 1913 level.

In the early 1930's the USSR was buying entire factories together with know-how and technicians and was utilizing the services of thousands of foreign engineers. In the late 1930's, exports of the USSR dropped to about half the 1930 level partly due to poor production performance in the traditional export lines and a growing philosophy of self-sufficiency as well as a world contraction in foreign trade.

During World War II USSR exports fell to almost nothing and she became almost wholly a receiver of goods from the West. Some $11 billion worth of Lend-Lease aid arrived in the USSR during the period of Soviet alliance with the West. After the war, export trade was resumed with great difficulty by the wartorn Soviet Union and this trade was largely with the newly acquired satellites.

The trade of the satellite areas before World War II had been strongly oriented toward the West. Taken as a group they were primarily exporters of foodstuffs and raw materials, Czechoslovakia and East Germany being the only two that could be termed industrialized. In exchange for the raw materials, these countries bought finished products manufactured in the industrialized West. In the post-war period trade between the satellites and the Free World decreased partly because of the destruction of the war but largely due to the realignment of their economies with the Soviet Bloc. The satellites also followed a deliberate policy of self-sufficiency under their Stalinist leaders; hence the trade between these countries and the Free World followed a pattern similar to that of the USSR.

During the first years following World War II, the Sino-Soviet Bloc trade with the Free World remained relatively constant at a low level as shown in Table 17-1. The reasons were both economic and political--economic, because agriculture in East Europe was slow in providing food surpluses for international trade; and political, because Stalin was convinced that an isolationist policy on the part of the Communist Bloc could work only to the advantage of the Bloc and the disadvantage of the West. Stalin had been successful in expanding the communistic regime to include a third of the world's population

TABLE 17-1

FREE WORLD TRADE WITH SOVIET BLOC
1947 - 1960
($U.S. Million)

FREE WORLD IMPORTS FROM * YEAR	USSR a/	EUROPEAN SATELLITES a/	CHINA & EASTERN BLOC COUNTRIES a/	TOTAL a/	TOTAL FREE WORLD IMPORTS b/	BLOC AS PERCENT OF WORLD
1947	273.9	732.9	417.9	1,424.7	56,307	2.5
1948	493.7	1,026.0	488.3	2,008.0	60,362	3.3
1949	280.7	1,089.9	426.2	1,796.8	59,907	3.0
1950	252.1	939.8	534.7	1,726.6	59,884	2.9
1951	390.6	967.5	524.9	1,883.0	82,100	2.3
1952	463.1	794.4	369.0	1,626.5	80,698	2.0
1953	374.1	803.2	442.7	1,620.0	76,972	2.1
1954	495.6	955.5	386.7	1,837.8	80,001	2.3
1955	635.6	1,283.7	496.9	2,416.2	89,497	2.7
1956	806.3	1,473.1	657.5	2,936.9	98,698	3.0
1957	1,041.9	1,520.2	647.4	3,209.5	107,902	3.0
1958	1,045.5	1,690.5	773.8	3,509.8	101,140	3.5
1959	1,236.9	1,772.0	718.5	3,727.4	106,590	3.5
1960	1,504.3	2,117.7	784.0	4,406.0	119,080	3.7
FREE WORLD EXPORTS TO *					TOTAL FREE WORLD EXPORTS b/	
1947	477.0	856.5	672.3	2,005.8	50,812	3.9
1948	533.5	900.7	534.3	1,968.5	54,257	3.6
1949	428.4	914.2	324.1	1,666.7	54,992	3.0
1950	301.1	791.6	452.1	1,544.8	57,240	2.7
1951	387.5	854.2	446.2	1,687.9	77,271	2.2
1952	483.3	682.4	272.6	1,438.3	74,391	1.9
1953	423.5	677.8	287.6	1,388.9	75,276	1.8
1954	576.7	896.0	294.4	1,767.1	78,070	2.3
1955	601.6	1,158.1	317.3	2,077.0	84,833	2.4
1956	784.1	1,318.5	434.2	2,536.8	94,146	2.7
1957	1,016.9	1,567.2	534.0	3,118.1	100,971	3.1
1958	1,013.0	1,634.0	779.3	3,426.3	96,110	3.6
1959	1,149.0	1,852.9	689.0	3,690.9	101,850	3.6
1960	1,565.0	2,175.4	702.4	4,442.8	113,530	3.9

* All countries for which data are available that imported from or exported to the Soviet Bloc merchandise valued at $1 million or more in any one year are included above.

Exports of all countries are valued f.o.b., port of shipment, except those from Canada and the Union of South Africa which are f.o.b. inland point of shipment, and those from Sudan (1947-52) and the United States which are valued at f.a.s.

Imports are valued c.i.f., except for following countries which value imports f.o.b. country of export: Australia, Canada, Cuba, Paraguay, Philippines, South West Africa, Union of South Africa, U. S., and Venezuela. New Zealand reports current domestic value, country of export.

Wherever possible, the statistics have been converted from original currency units to United States dollars at the rates published by the International Monetary Fund. Otherwise, rates as reported by the countries themselves have been used.

a/ 1/
b/ 2/

and he believed that serious economic problems would be created in the West by denying this vast market to the capitalist countries.

Exports from the European satellites to the Free World were at a level of about $900 million per year from 1949 to 1953. China's exports were at about $400 million per year during the same period. For the entire Soviet Bloc, exports to (or imports from) the Free World gradually declined from a 1948 level of about $2 billion, or 3-1/2 percent of the entire Free World trade, to about $1.5 billion in 1953, or 2 percent of total Free World trade.

With the death of Stalin in 1953, the commercial policy of the Communists towards the Free World was reversed almost immediately. The reasons behind this shift are difficult to assess, but up to Stalin's death the postwar foreign policy of the USSR was not especially successful. A new approach was needed. It is apparent that the new regime realized that limited commerce with the Free World was denying the Communist Bloc needed technology and industrial equipment. Furthermore, they were aware that all of the opportunities offered by trade to spread Communism were not being exploited. While the basic objectives of the Communists towards the Free World remained the same, the tactics through which they sought to achieve them were changed. The new party line became "peaceful co-existence" through trade. The Soviet Trade Ministry moved vigorously to conclude a large number of bi-lateral trade aggreements. Orders were placed for a wide range of industrial equipment, plants and transportation equipment. Free World imports from the USSR rose from about $374 million in 1953 to $1,504 million in 1960. A similar trend was also evident for the European satellites and China. Shipments to the Free World from the European satellites rose from $803 million in 1953 to $2,118 million in 1960. For China the increase was from $443 million to $784 million. Thus exports from the entire Bloc to the Free World nearly tripled in the years 1953 to 1960, growing from $1.6 billion to $4.4 billion. Imports from the Free World had a corresponding increase from $1.4 billion to $4.4 billion. In 1960, the Bloc was participating in Free World trade to the extent of about 3.8 percent. Hence in terms of relative significance, Bloc trade with the Free World had doubled since 1953 when it represented less than 2 percent.

Table 17-2 shows the total volume of Soviet Bloc trade in 1960 with each of the Free World trading countries. Two-thirds of the East-West trade in 1960 is attributable to Western

TABLE 17-2

VALUE OF IMPORTS FROM AND EXPORTS TO THE SOVIET BLOC a/
1 9 6 0
($US Million)

	IMPORTS			EXPORTS		
COUNTRY	FROM TOTAL WORLD	FROM SOVIET BLOC AMOUNT	FROM SOVIET BLOC PERCENT	TO TOTAL WORLD	TO SOVIET BLOC AMOUNT	TO SOVIET BLOC PERCENT b/
NORTH AMERICA						
Canada	5,648.6	19.2	0.3	5,314.8	45.7	0.9
Mexico	1,186.4	3.6	0.3	656.2	1.7	0.3
United States	14,653.9	83.8	0.6	20,500.0	193.4	0.9
TOTAL	21,488.9	106.6		26,471.0	240.8	
CARIBBEAN						
Cuba	600.0 c/	74.8	12.5	618.2	149.5	24.2
SOUTH AMERICA						
Argentina	1,249.3	47.9	3.8	1,079.2	61.1	5.7
Brazil	1,462.1	79.6	5.4	1,268.8	71.5	5.6
British Guiana	86.1	1.3	1.5	NA	NA	NA
Chile	499.7	1.1	0.2	490.0	0.6	0.1
Columbia	514.4	5.4	1.0	464.2	8.1	1.7
Equador	115.2	0.4	0.3	104.7	-	-
Peru	375.0	1.3	0.3	133.0	0.1	-
Uruguay	228.6	15.0	6.6	129.4	13.4	10.4
Venezuela	1,066.1	5.9	0.6			
TOTAL	5,596.5	157.9		3,669.3	154.8	
WESTERN EUROPE						
Austria	1,415.8	164.2	11.6	1,120.3	166.6	14.9
Belgium-Luxembourg	3,957.1	87.8	2.2	3,775.4	141.3	3.7
Denmark	1,795.1	95.9	5.3	1,463.1	60.4	4.1
Finland	1,060.2	219.1	20.7	989.1	193.1	19.5
France	6,281.0	177.4	2.8	6,864.4	275.2	4.0
West Germany	10,369.9	719.4	6.9	11,643.3	765.0	6.6
Greece	702.0	55.5	7.9	203.2	44.9	22.1
Iceland	84.3	20.6	24.4	66.7	16.4	24.6
Ireland	633.9	8.3	1.3	426.7	0.5	0.1
Italy	4,721.5	289.5	6.1	3,649.6	212.2	5.8
Netherlands	4,531.4	119.4	2.6	4,028.4	69.6	1.7
Norway	1,461.4	49.2	3.4	880.5	42.6	4.8
Portugal	545.5	8.2	1.5	327.2	7.5	2.3
Spain	721.6	11.5	1.6	725.5	18.4	2.5
Sweden	2,876.3	127.4	4.4	2,566.6	123.6	4.8
Switzerland	2,245.1	57.5	2.6	1,892.0	70.0	3.7
United Kingdom	12,758.1	459.1	3.6	10,297.3	360.2	3.5
Yugoslavia	826.3	212.3	25.7	566.1	183.3	32.4
TOTAL	56,986.5	2,882.3		51,485.4	2,750.8	
MIDDLE EAST						
Aden	214.4	3.9	1.8	168.1	0.1	-
Cyprus	109.7	2.7	2.5	53.6	1.4	2.6
Iran	580.7	30.4	5.2	96.9 d/	28.0 d/	28.9
Iraq	390.7	38.0	9.7	22.3 d/	3.4 d/	15.2
Israel	496.2	4.2	0.8	219.9	3.8	1.7
Jordan	120.2	7.2	6.0	9.7	1.1	11.3
Lebanon	394.9	17.1	4.3	68.8	3.2	4.7
Malta	82.9	1.2	1.4	NA	NA	NA
Syria	217.7	19.3	8.9	96.3	22.3	23.2
Turkey	467.7	42.6	9.1	320.4	39.2	12.2
TOTAL	3,075.1	166.6		1,056.0	102.5	

a/ 3/
b/ Dash indicates negligible or known to be zero.
c/ Estimate.
d/ Export values exclude oil shipments.

(Cont'd)

TABLE 17-2

VALUE OF IMPORTS FROM AND EXPORTS TO THE SOVIET BLOC a/
1 9 6 0
($US Million)

COUNTRY	IMPORTS FROM TOTAL WORLD	IMPORTS FROM SOVIET BLOC AMOUNT	IMPORTS FROM SOVIET BLOC PERCENT	EXPORTS TO TOTAL WORLD	EXPORTS TO SOVIET BLOC AMOUNT	EXPORTS TO SOVIET BLOC PERCENT b/
AFRICA						
Algeria	1,265.3	10.8	0.9	394.4	2.2	0.6
Angola	127.6	0.4	0.3	124.0	2.6	2.1
Cameroun	84.5	1.0	1.2	97.0	0.5	0.5
Congo Republic	179.3	2.1	1.2	337.7	0.8	0.2
Egypt	646.4	161.2	24.9	550.0	244.3	44.4
Ethiopia	88.3	4.6	5.2	80.8	0.9	1.1
Ghana	362.9	15.0	4.1	325.2	22.5	6.9
Guinea	49.9	22.0	44.1	55.1	12.6	22.9
Libya	165.3	2.4	1.5	11.3	0.7	6.2
Morocco	413.0	22.7	5.5	353.9	16.0	4.5
Nigeria	602.5	16.7	2.8	461.7	9.6	2.1
Rhodesia and Nyasaland	439.2	2.0	0.5	576.4	17.0	3.0
Senegal, Mali and Mauritania	172.1	6.5	3.8	NA	NA	NA
Sudan	189.9	16.7	8.8	182.0	23.6	13.0
Togo	26.1	-	0.1	14.5	0.1	0.7
Tunisia	190.7	6.7	3.5	119.7	3.9	3.3
Uganda	40.4	0.1	0.2	120.2	5.1	4.2
Union of South Africa	1,556.0	14.5	0.9	1,226.3	18.9	1.5
TOTAL	6,599.4	305.4		5,030.2	381.3	
SOUTH ASIA, FAR EAST AND OCEANIA						
Afghanistan	71.9	32.2	44.8	81.2	16.8	20.7
Australia	2,367.6	25.0	1.1	2,054.7	96.7	4.7
Burma	259.3	35.4	13.7	223.7	14.9	6.7
Ceylon	411.5	32.4	7.9	384.6	37.5	9.8
Hong Kong	1,026.1	215.4	21.0	689.1	22.7	3.3
India	2,123.8	74.4	3.5	1,333.2	108.3	8.1
Indonesia	574.1	72.4	12.6	840.4	70.3	8.4
Japan	4,491.1	125.0	2.8	4,054.9	73.4	1.8
Malaya and Singapore	1,480.7	64.0	4.3	1,538.2	143.9	9.4
New Zealand	700.6	3.0	0.4	790.5	26.0	3.3
Pakistan	653.5	14.9	2.3	393.4	30.7	7.8
South Vietnam and Cambodia	95.0	14.4	15.2	69.7	7.0	10.0
Taiwan	296.8	2.2	0.7	NA	NA	NA
Thailand	456.2	5.5	1.2	408.4	8.8	2.2
TOTAL	15,008.2	716.2		12,862.0	657.0	
GRAND TOTAL	109,354.6	4,409.8		101,492.1	4,436.7	

a/ 3/
b/ Dash indicates negligible or known to be zero.
c/ Estimate.
d/ Export values exclude oil shipments.

Europe with widely varying degrees of dependence on such trade between individual countries. Finland, Iceland, Yugoslavia and Greece showed the greatest proportions of Bloc trade in total international trade. West Germany is by far the largest trader with the Bloc although such trade represents only about 7 percent of her total trade. Table 17-2 also shows the high degree of dependence of some of the developing countries in Africa and Asia on Sino-Soviet Bloc trade.

Figures from the U.S. Department of Commerce showing the types of materials traded between the Sino-Soviet Bloc and individual Free World countries in 1960 are listed in Tables 17-3 and 17-4. Totals are as follows:

FREE WORLD TRADE WITH
SINO-SOVIET BLOC - 1960
($ U.S. Million)

COMMODITY	EXPORTS TO BLOC	IMPORTS FROM BLOC
Food, Beverages, and Tobacco	667.0	920.8
Chemicals	302.7	243.5
Metals and Metal Shapes	902.1	343.5
Machinery and Plants	625.8	289.8
Transport Equipment	180.3	141.3
Other Manufactured	431.2	767.0
Crude Material	1,275.0	831.8
Fuels (Excluding Oil)	11.2	314.6
Total Oil	6.6	450.3
Miscellaneous	40.4	66.4
TOTAL	4,442.3	4,369.0

The bulk of the Free World sales to the Bloc in 1960 were in crude materials, metals, chemicals, machinery and plants, and manufactured goods. Half of the total crude materials exports of $1.3 billion* were textile fibers, including synthetic fibers. Rubber accounted for about one-fourth of the crude materials, and the remaining quarter included such items as ores, minerals, hides, pulp, and wood. Sugar and grains represented the largest food items of Bloc purchases, and electrical equipment the largest category in machinery and plants.

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* Minor inconsistencies in trade numbers may be noted throughout Part VI, due to the variety of sources used.

Food, crude materials, manufactured goods, and fuels represented the major Free World imports from the Bloc in 1960. Petroleum (including petroleum products) was by far the largest single item, and represented between 10 and 11 percent of all imports from the USSR and her satellites.

TABLE 17-3

VALUE OF FREE WORLD EXPORTS TO SOVIET BLOC BY MAJOR CATEGORY a/ b/
1960
($ U.S. Million)

COUNTRY	FOOD, BEVERAGES & TOBACCO	CHEMICALS	METALS & METAL SHAPES	MACHINERY & PLANTS	TRANSPORT EQUIPMENT	CRUDE MATERIALS	OTHER MANUFACTURED	MISCELLANEOUS	FUELS EXCEPT OIL	PETROLEUM: CRUDE OIL	PETROLEUM: PETROLEUM PRODUCTS	PETROLEUM: TOTAL PETROLEUM	TOTAL EXPORTS TO BLOC d/
NORTH AMERICA													
Canada	13.7	6.6	20.5	0.1	-	4.3	0.4	0.1	-	-	-	-	45.7
Mexico	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.7
United States	101.9	6.0	15.5	21.8	1.9	37.9	8.3	0.1	-	-	-	-	193.4
TOTAL	115.6	12.6	36.0	21.9	1.9	42.2	8.7	0.2	-	-	-	-	240.8
CARIBBEAN													
Cuba	148.4	-	-	-	-	1.0	0.1	-	-	-	-	-	149.5
SOUTH AMERICA													
Argentina	1.5	3.7	-	-	-	55.8	2.7	0.1	-	-	-	-	63.8
Brazil	45.8	-	-	-	-	25.7	0.8	-	-	-	-	-	72.3
British Guiana	-	-	-	-	-	-	-	-	-	-	-	-	NA
Chile	-	-	-	-	-	-	-	-	-	-	-	-	0.6
Columbia	8.1	-	-	-	-	-	-	-	-	-	-	-	8.1
Equador	-	-	-	-	-	-	-	-	-	-	-	-	-
Peru	-	-	-	-	-	-	-	-	-	-	-	-	0.1
Uraguay	0.2	-	-	-	-	13.1	0.1	-	-	-	-	-	13.4
Venezuela	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	55.6	3.7	-	-	-	94.6	3.6	0.1	-	-	-	-	158.3
WESTERN EUROPE													
Austria	0.7	12.5	67.8	36.6	9.8	12.1	26.8	0.3	-	-	-	-	166.6
Belgium-Luxembourg	1.4	16.0	84.4	6.5	3.6	16.4	8.3	4.6	-	-	0.1	0.1	141.4
Denmark	20.0	3.3	0.2	10.5	15.4	8.4	2.6	0.1	-	-	-	-	60.5
Finland	5.1	0.7	8.8	22.3	65.1	45.1	46.3	-	-	-	-	-	193.4
France	5.3	17.6	115.5	92.8	0.7	11.3	31.4	0.6	-	-	-	-	275.2
West Germany	27.0	91.4	317.4	206.3	16.0	21.7	73.8	0.9	10.1	-	0.8	0.8	766.2
Greece	26.8	0.4	0.1	-	-	13.2	2.1	2.3	-	-	-	-	44.9
Iceland	15.3	-	-	-	-	0.5	0.5	0.1	-	-	-	-	16.4
Ireland	-	-	-	-	-	-	-	-	-	-	-	-	0.5
Italy	13.9	38.7	59.6	33.9	4.5	21.7	32.3	7.5	-	-	0.1	0.1	212.3
Netherlands	7.1	14.0	5.9	7.4	8.4	10.7	8.5	10.0	-	-	0.2	0.2	72.4
Norway	13.0	3.2	7.1	0.2	2.2	11.2	10.6	0.1	-	-	-	-	47.6
Portugal	0.4	-	-	-	-	6.2	0.8	0.1	-	-	-	-	7.5
Spain	7.5	0.1	2.7	0.2	-	2.0	5.9	-	-	-	-	-	18.4
Sweden	9.9	4.4	26.3	31.8	6.4	32.8	11.6	0.4	-	-	-	-	123.6
Switzerland	0.4	22.8	0.6	24.7	5.9	1.0	13.6	1.0	-	-	-	-	70.0
United Kingdom	2.2	38.8	94.2	98.3	7.0	75.4	35.2	8.7	-	-	0.4	0.4	360.6
Yugoslavia	39.6	10.9	35.9	23.5	20.7	22.5	29.0	0.2	1.0	-	-	-	183.3
TOTAL	195.6	274.8	826.5	595.0	165.7	312.2	339.3	36.9	11.1	-	1.6	1.6	2,760.8
MIDDLE EAST													
Aden	-	-	-	-	-	0.1	-	-	-	-	-	-	0.1
Cyprus	1.4	-	-	-	-	-	-	-	-	-	-	-	1.4
Iran	6.0	-	-	-	-	12.7	9.3	-	-	- c/	- c/	- c/	28.0
Iraq	2.4	-	-	-	-	1.0	-	-	-	- c/	- c/	- c/	3.4
Israel	NA	NA	NA	NA	NA	NA	NA	-	NA	NA	NA	NA	3.8
Jordan	-	1.1	-	-	-	-	-	-	-	[illegible]	[illegible]	[illegible]	[illegible]

MIDDLE EAST													
Aden	-	-	-	-	-	0.1	-	-	-	-	-	-	0.1
Cyprus	1.4	-	-	-	-	-	-	-	-	-	-	-	1.4
Iran	6.0	-	-	-	-	12.7	9.3	-	-	- c/	- c/	- c/	28.0
Iraq	2.4	-	-	-	-	1.0	-	-	-	- c/	- c/	- c/	3.4
Israel	NA	NA	NA	NA	NA	NA	NA	-	NA	NA	NA	NA	3.8
Jordan	-	1.1	-	-	-	-	-	-	-	-	-	-	1.1
Lebanon	1.7	-	-	-	-	0.8	0.7	-	-	-	-	-	3.2
Malta	NA	NA	NA	NA	NA	NA	NA	-	NA	NA	NA	NA	NA
Syria	-	-	-	-	-	21.6	-	0.7	-	-	-	-	22.3
Turkey	20.1	-	0.4	-	-	13.0	5.7	-	-	-	-	-	39.2
TOTAL	31.6	1.1	0.4	-	-	49.2	15.7	0.7	-	-	-	-	102.5
AFRICA													
Algeria	0.4	-	-	-	-	1.8	-	-	-	-	-	-	2.2
Angola	-	-	-	-	-	-	-	-	-	-	-	-	2.6
Cameroun	0.4	-	-	-	-	0.1	-	-	-	-	-	-	0.5
Congo Republic	-	-	-	-	-	0.8	-	-	-	-	-	-	0.8
Egypt	3.0	0.1	-	-	-	227.9	11.6	-	-	-	1.7	1.7	246.0
Ethiopia	0.3	-	-	-	-	0.5	0.1	-	-	-	-	-	0.9
Ghana	22.5	-	-	-	-	-	-	-	-	-	-	-	22.5
Guinea	7.0	-	-	-	-	5.2	0.1	0.3	-	-	-	-	12.6
Libya	-	-	-	-	-	0.7	-	-	-	-	-	-	0.7
Morocco	4.2	-	0.2	-	0.2	11.3	0.1	-	-	-	-	-	16.0
Nigeria	5.5	-	-	-	-	4.1	-	-	-	-	-	-	9.6
Rhodesia & Nyasaland	15.8	-	-	-	-	1.2	-	-	-	-	-	-	17.0
Senegal, Mali & Mauritania	-	-	-	-	-	-	-	-	-	-	-	-	NA
Sudan	-	-	-	-	-	23.4	-	0.2	-	-	-	-	23.6
Togo	0.1	-	-	-	-	-	-	-	-	-	-	-	0.1
Tunisia	0.1	1.5	-	-	-	1.8	0.5	-	-	-	-	-	3.9
Uganda	-	-	-	-	-	5.1	-	-	-	-	-	-	5.1
Union of South Africa	0.1	1.5	0.5	-	-	16.4	0.3	0.1	-	-	-	-	18.9
TOTAL	59.4	3.1	0.7	-	0.2	300.3	12.7	0.6	-	-	1.7	1.7	383.0
SOUTH ASIA, FAR EAST & OCEANIA													
Afghanistan	2.1	-	-	-	-	14.6	0.1	-	-	-	-	-	16.8
Australia	3.1	0.8	0.5	-	-	90.8	0.8	0.7	-	-	-	-	96.7
Burma	7.5	-	-	-	-	7.0	0.4	-	-	-	-	-	14.9
Ceylon	1.5	-	-	-	-	35.3	0.7	-	-	-	-	-	37.5
Hong Kong	0.3	2.1	8.5	1.5	1.2	4.1	4.9	-	-	-	0.1	0.1	22.8
India	40.7	0.4	-	-	0.1	42.8	26.4	0.3	0.1	-	0.4	0.4	111.6
Indonesia	1.3	-	-	0.3	-	68.1	0.1	0.6	-	-	-	-	70.4
Japan	0.7	4.1	29.5	7.1	11.2	6.8	14.0	-	-	-	-	-	73.4
Malaya & Singapore	0.9	-	-	-	-	138.7	1.4	0.1	-	-	2.8	2.8	146.7
New Zealand	-	-	-	-	-	24.3	1.7	-	-	-	-	-	26.0
Pakistan	-	-	-	-	-	30.4	0.1	0.2	-	-	-	-	30.7
South Vietnam & Cambodia	2.7	-	-	-	-	4.0	0.3	-	-	-	-	-	7.0
Taiwan	-	-	-	-	-	-	-	-	-	-	-	-	NA
Thailand	-	-	-	-	-	8.6	0.2	-	-	-	-	-	8.8
TOTAL	60.8	7.4	38.5	8.9	12.5	475.5	51.1	1.9	0.1	-	3.3	3.3	663.3
GRAND TOTAL	667.0	302.7	902.1	625.8	180.3	1,275.0	431.2	40.4	11.2	-	6.6	6.6	4,458.2

a/ 4/
b/ Dash indicates negligible or known to be zero.
c/ Export values exclude oil shipments.
d/ Totals may differ slightly from Table 17-2 due to difference in source.

TABLE 17-4

VALUE OF FREE WORLD IMPORTS FROM SOVIET BLOC BY MAJOR CATEGORY a/ b/
1960
($U.S. Million)

COUNTRY	FOOD BEVERAGES & TOBACCO	CHEMICALS	METALS & METAL SHAPES	MACHINERY & PLANTS	TRANSPORT EQUIPMENT	CRUDE MATERIALS	OTHER MANUFACTURED	MISCELLANEOUS	FUELS EXCEPT OIL	BLOC OIL IMPORTS		
										CRUDE OIL	PRODUCTS	TOTAL
NORTH AMERICA												
Canada	3.5	1.7	0.2	1.0	0.5	2.7	9.5	0.1	-	-	-	-
Mexico	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
United States	30.3	11.1	6.2	1.6	2.6	17.2	11.8	3.0	-	-	-	-
TOTAL	33.8	12.8	6.4	2.6	3.1	19.9	21.3	3.1	-	-	-	-
CARIBBEAN												
Cuba	11.8	3.7	10.0	6.4	4.5	1.9	8.8	-	-	18.5	9.2	27.7
SOUTH AMERICA												
Argentina	-	0.8	9.7	19.0	5.0	0.8	1.5	-	10.8	-	0.3	0.3
Brazil	16.7	6.9	8.6	23.1	16.7	-	2.5	0.1	-	0.6	4.4	5.0
British Guiana	-	-	-	-	-	-	-	-	-	-	-	-
Chile	-	-	-	-	-	-	-	-	-	-	-	-
Columbia	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Equador	-	-	-	-	-	-	-	-	-	-	-	-
Peru	-	-	-	-	-	-	-	-	-	-	-	-
Uruguay	0.1	0.8	1.7	0.4	0.1	0.5	0.6	0.5	0.1	5.7	4.5	10.2
Venezuela	3.2	-	-	-	-	-	2.7	-	-	-	-	-
TOTAL	20.0	8.5	20.0	42.5	21.8	1.3	7.3	0.6	10.9	6.3	9.2	15.5
WESTERN EUROPE												
Austria	41.8	6.5	10.5	7.9	4.8	29.9	4.7	0.3	47.6	-	10.2	10.2
Belgium - Luxembourg	17.0	6.5	9.7	1.8	4.5	24.8	7.6	10.2	0.1	-	5.6	5.6
Denmark	17.6	6.0	7.5	2.9	1.2	18.2	15.1	0.1	24.3	-	3.0	3.0
Finland	42.3	13.0	23.8	5.0	15.7	25.0	11.2	0.4	30.9	12.9	38.9	51.8
France	18.4	7.1	9.7	5.2	1.9	55.2	8.5	2.0	33.5	2.7	33.2	35.9
West Germany	167.8	38.2	54.3	26.5	3.1	168.6	88.6	3.8	79.3	13.3	75.9	89.2
Greece	6.5	3.7	3.2	4.8	1.7	8.8	6.1	2.4	2.7	7.4	8.2	15.6
Iceland	1.6	0.8	1.6	0.9	1.2	1.3	4.2	-	0.6	-	8.9	8.9
Ireland	0.6	1.3	-	-	0.4	2.2	2.0	-	1.8	-	-	-
Italy	53.9	18.2	34.8	5.2	0.2	57.6	25.5	11.7	20.5	48.4	13.5	61.9
Netherlands	29.3	6.3	10.7	4.3	1.7	37.9	23.2	3.1	1.8	-	1.1	1.1
Norway	17.5	1.9	0.9	1.4	3.4	8.3	9.0	0.1	1.1	-	5.6	5.6
Portugal	3.8	-	0.1	0.9	0.4	0.2	0.6	0.1	0.6	-	1.5	1.5
Spain	0.6	1.2	0.4	3.8	1.5	0.1	3.9	-	-	-	-	-
Sweden	20.9	11.9	17.7	2.6	0.5	10.2	18.5	0.2	12.4	-	32.5	32.5
Switzerland	19.1	7.0	2.5	1.6	0.4	10.7	11.0	1.2	2.3	-	1.7	1.7
United Kingdom	128.1	20.2	27.7	3.9	0.7	219.1	51.4	2.4	-	-	5.6	5.6
Yugoslavia	19.3	19.8	25.8	48.4	21.9	7.5	39.4	0.1	18.8	5.9	5.4	11.3
TOTAL	606.1	169.1	240.9	127.1	65.2	685.6	330.5	38.1	278.3	90.6	250.8	341.4
MIDDLE EAST												
Aden	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cyprus	-	-	-	-	-	-	-	-	-	-	-	-
Iran	3.3	0.6	2.8	3.6	0.9	2.3	16.7	-	-	-	0.2	0.2
Iraq	5.9	0.5	2.7	2.5	1.6	2.1	19.4	3.3	-	-	-	-
Israel	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Jordan	1.8	-	0.1	0.3	-	1.2	3.8	-	-	-	-	-
Lebanon	2.2	-	1.4	0.4	0.2	3.4	8.6	-	-	-	0.9	0.9
Malta	-	-	-	-	-	-	-	-	-	-	-	-
Syria	-	0.3	2.6	2.4	0.2	3.5	1.1	5.4	-	-	3.8	3.8
[illegible]	-	2.6	3.1	15.5	6.0	1.0	14.3	-	-	-	0.1	0.1

TABLE 17-4

VALUE OF FREE WORLD IMPORTS FROM SOVIET BLOC BY MAJOR CATEGORY a/ b/
1960
($U.S. Million)

COUNTRY	FOOD BEVERAGES & TOBACCO	CHEMICALS	METALS & METAL SHAPES	MACHINERY & PLANTS	TRANSPORT EQUIPMENT	CRUDE MATERIALS	OTHER MANUFACTURED	MISCELLANEOUS	FUELS EXCEPT OIL	BLOC OIL IMPORTS			TOTAL IMPORTS FROM BLOC c/
										CRUDE OIL	PRODUCTS	TOTAL	
AMERICA													
nada	3.5	1.7	0.2	1.0	0.5	2.7	9.5	0.1	-	-	-	-	19.2
xico	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.6
ited States	30.3	11.1	6.2	1.6	2.6	17.2	11.8	3.0	-	-	-	-	83.8
TOTAL	33.8	12.8	6.4	2.6	3.1	19.9	21.3	3.1	-	-	-	-	106.6
EAN													
a	11.8	3.7	10.0	6.4	4.5	1.9	8.8	-	-	18.5	9.2	27.7	74.8
AMERICA													
gentina	-	0.8	9.7	19.0	5.0	0.8	1.5	-	10.8	-	0.3	0.3	47.9
azil	16.7	6.9	8.6	23.1	16.7	-	2.5	0.1	-	0.6	4.4	5.0	79.6
itish Guiana	-	-	-	-	-	-	-	-	-	-	-	-	1.3
le	-	-	-	-	-	-	-	-	-	-	-	-	1.1
umbia	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5.4
ador	-	-	-	-	-	-	-	-	-	-	-	-	0.4
ru	-	-	-	-	-	-	-	-	-	-	-	-	1.3
guay	0.1	0.8	1.7	0.4	0.1	0.5	0.6	0.5	0.1	5.7	4.5	10.2	15.0
ezuela	3.2	-	-	-	-	-	2.7	-	-	-	-	-	5.9
TOTAL	20.0	8.5	20.0	42.5	21.8	1.3	7.3	0.6	10.9	6.3	9.2	15.5	157.9
EUROPE													
tria	41.8	6.5	10.5	7.9	4.8	29.9	4.7	0.3	47.6	-	10.2	10.2	164.2
gium - Luxembourg	17.0	6.5	9.7	1.8	4.5	24.8	7.6	10.2	0.1	-	5.6	5.6	87.8
mark	17.6	6.0	7.5	2.9	1.2	18.2	15.1	0.1	24.3	-	3.0	3.0	95.9
land	42.3	13.0	23.8	5.0	15.7	25.0	11.2	0.4	30.9	12.9	38.9	51.8	219.1
nce	18.4	7.1	9.7	5.2	1.9	55.2	8.5	2.0	33.5	2.7	33.2	35.9	177.4
t Germany	167.8	38.2	54.3	26.5	3.1	168.6	88.6	3.8	79.3	13.3	75.9	89.2	719.4
eece	6.5	3.7	3.2	4.8	1.7	8.8	6.1	2.4	2.7	7.4	8.2	15.6	55.5
land	1.6	0.8	1.6	0.9	1.2	1.3	4.2	-	0.6	-	8.9	8.9	20.6
land	0.6	1.3	-	-	0.4	2.2	2.0	-	1.8	-	-	-	8.3
ly	53.9	18.2	34.8	5.2	0.2	57.6	25.5	11.7	20.5	48.4	13.5	61.9	289.5
herlands	29.3	6.3	10.7	4.3	1.7	37.9	23.2	3.1	1.8	-	1.1	1.1	119.4
way	17.5	1.9	0.9	1.4	3.4	8.3	9.0	0.1	1.1	-	5.6	5.6	49.2
tugal	3.8	-	0.1	0.9	0.4	0.2	0.6	0.1	0.6	-	1.5	1.5	8.2
in	0.6	1.2	0.4	3.8	1.5	0.1	3.9	-	-	-	-	-	11.5
den	20.9	11.9	17.7	2.6	0.5	10.2	18.5	0.2	12.4	-	32.5	32.5	127.4
tzerland	19.1	7.0	2.5	1.6	0.4	10.7	11.0	1.2	2.3	-	1.7	1.7	57.5
ted Kingdom	128.1	20.2	27.7	3.9	0.7	219.1	51.4	2.4	-	-	5.6	5.6	459.1
oslavia	19.3	19.8	25.8	48.4	21.9	7.5	39.4	0.1	18.8	5.9	5.4	11.3	212.3
TOTAL	606.1	169.1	240.9	127.1	65.2	685.6	330.5	38.1	278.3	90.6	250.8	341.4	2,882.3
EAST													
n	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.9
rus	-	-	-	-	-	-	-	-	-	-	-	-	2.7
n	3.3	0.6	2.8	3.6	0.9	2.3	16.7	-	-	-	0.2	0.2	30.4
q	5.9	0.5	2.7	2.5	1.6	2.1	19.4	3.3	-	-	-	-	38.0
ael	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.2
dan	1.8	-	0.1	0.3	-	1.2	3.8	-	-	-	-	-	7.2
anon	2.2	-	1.4	0.4	0.2	3.4	8.6	-	-	-	0.9	0.9	17.1
ta	-	-	-	-	-	-	-	-	-	-	-	-	1.2
ia	-	0.3	2.6	2.4	0.2	3.5	1.1	5.4	-	-	3.8	3.8	19.3
key	-	2.6	3.1	15.5	6.0	1.0	14.3	-	-	-	0.1	0.1	42.6

MIDDLE EAST													
Aden	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.9
Cyprus	-	-	-	-	-	-	-	-	-	-	-	-	2.7
Iran	3.3	0.6	2.8	3.6	0.9	2.3	16.7	-	-	-	0.2	0.2	30.4
Iraq	5.9	0.5	2.7	2.5	1.6	2.1	19.4	3.3	-	-	-	-	38.0
Israel	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.2
Jordan	1.8	-	0.1	0.3	-	1.2	3.8	-	-	-	-	-	7.2
Lebanon	2.2	-	1.4	0.4	0.2	3.4	8.6	-	-	-	0.9	0.9	17.1
Malta	-	-	-	-	-	-	-	-	-	-	-	-	1.2
Syria	-	0.3	2.6	2.4	0.2	3.5	1.1	5.4	-	-	3.8	3.8	19.3
Turkey	-	2.6	3.1	15.5	6.0	1.0	14.3	-	-	-	0.1	0.1	42.6
TOTAL	13.2	4.0	12.7	24.7	8.9	13.5	63.9	8.7	-	-	5.0	5.0	166.6
AFRICA													
Algeria	3.4	-	-	0.1	-	5.3	1.3	-	-	-	0.7	0.7	10.
Angola	-	-	-	-	-	-	-	-	-	-	-	-	0.
Cameroun	-	-	-	-	-	-	-	-	-	-	-	-	1.
Congo Republic	-	-	-	-	-	-	-	-	-	-	-	-	2.
Egypt	10.5	14.9	20.4	27.8	5.4	15.6	27.6	1.2	1.6	10.1	26.1	36.2	161.
Ethiopia	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.
Ghana	1.0	0.4	0.4	0.3	0.1	-	12.8	-	-	-	-	-	15.
Guinea	4.3	1.1	0.5	1.5	3.1	-	6.9	3.8	-	-	0.8	0.8	22.
Libya	-	-	-	-	-	-	-	-	-	-	-	-	2.
Morocco	11.4	0.2	0.3	0.6	0.2	2.4	5.6	-	1.0	0.8	0.2	1.0	22.
Nigeria	1.4	-	0.1	-	0.1	-	15.1	0.1	-	-	-	-	16.
Rhodesia & Nyasaland	-	0.1	0.1	0.1	0.1	-	1.6	-	-	-	-	-	2.
Senegal, Mali & Mauritania	6.4	-	-	-	-	-	0.1	-	-	-	-	-	6.
Sudan	4.3	-	-	-	-	1.3	6.0	5.0	0.1	-	-	-	16.
Togo	-	-	-	-	-	-	-	-	-	-	-	-	
Tunisia	1.0	-	-	-	-	-	5.7	-	-	-	-	-	6.
Uganda	-	-	-	-	-	-	-	-	-	-	-	-	0.
Union of South Africa	0.2	0.7	-	0.8	0.3	0.8	9.3	2.4	-	-	-	-	14.
TOTAL	43.9	17.4	21.8	31.2	9.3	25.4	92.0	12.5	2.7	10.9	27.8	38.7	305.
SOUTH ASIA, FAR EAST & OCEANIA													
Afghanistan	4.4	0.1	0.9	18.6	1.9	-	3.4	-	-	-	2.9	2.9	32.
Australia	1.5	1.1	0.4	1.3	0.5	7.9	12.1	0.2	-	-	-	-	25.
Burma	2.8	-	0.7	1.1	-	-	30.8	-	-	-	-	-	35.
Ceylon	25.5	0.2	0.7	0.2	0.3	0.3	5.2	-	-	-	-	-	32.
Hong Kong	96.3	3.9	3.3	2.2	0.1	25.6	81.1	0.1	2.8	-	-	-	215.
India	0.8	9.9	20.2	24.3	2.0	1.7	13.3	1.9	-	-	0.3	0.3	74.
Indonesia	13.7	0.7	2.5	2.2	0.8	0.2	52.2	0.1	-	-	-	-	72.
Japan	16.5	8.3	-	1.7	21.1	39.6	1.4	0.3	17.3	15.2	3.6	18.8	125.
Malaya & Singapore	24.9	2.7	1.2	0.5	0.5	7.4	26.6	0.1	0.1	-	-	-	64.
New Zealand	-	-	-	-	-	-	-	-	-	-	-	-	3.
Pakistan	3.4	0.6	1.5	1.5	0.3	0.9	3.6	0.6	2.5	-	-	-	14.
South Vietnam & Cambodia	2.2	0.5	0.3	1.2	1.0	0.6	8.5	0.1	-	-	-	-	14.
Taiwan	-	-	-	-	-	-	-	-	-	-	-	-	2.
Thailand	-	-	-	0.5	-	-	5.0	-	-	-	-	-	5.
TOTAL	192.0	28.0	31.7	55.3	28.5	84.2	243.2	3.4	22.7	15.2	6.8	22.0	716.
GRAND TOTAL	920.8	243.5	343.5	289.8	141.3	831.8	767.0	66.4	314.6	141.5	308.8	450.3	4,409.

a/ 5/
b/ Dash indicates negligible or known to be zero.
c/ Totals may differ slightly from Table 17-2 due to difference in source.

EAST													
en	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.9
prus	-	-	-	-	-	-	-	-	-	-	-	-	2.7
an	3.3	0.6	2.8	3.6	0.9	2.3	16.7	-	-	-	0.2	0.2	30.4
aq	5.9	0.5	2.7	2.5	1.6	2.1	19.4	3.3	-	-	-	-	38.0
rael	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.2
rdan	1.8	-	0.1	0.3	-	1.2	3.8	-	-	-	-	-	7.2
banon	2.2	-	1.4	0.4	0.2	3.4	8.6	-	-	-	0.9	0.9	17.1
lta	-	-	-	-	-	-	-	-	-	-	-	-	1.2
ria	-	0.3	2.6	2.4	0.2	3.5	1.1	5.4	-	-	3.8	3.8	19.3
rkey	-	2.6	3.1	15.5	6.0	1.0	14.3	-	-	-	0.1	0.1	42.6
TOTAL	13.2	4.0	12.7	24.7	8.9	13.5	63.9	8.7	-	-	5.0	5.0	166.6
:													
geria	3.4	-	-	0.1	-	5.3	1.3	-	-	-	0.7	0.7	10.8
gola	-	-	-	-	-	-	-	-	-	-	-	-	0.4
meroun	-	-	-	-	-	-	-	-	-	-	-	-	1.0
ngo Republic	-	-	-	-	-	-	-	-	-	-	-	-	2.1
ypt	10.5	14.9	20.4	27.8	5.4	15.6	27.6	1.2	1.6	10.1	26.1	36.2	161.2
hiopia	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.6
ana	1.0	0.4	0.4	0.3	0.1	-	12.8	-	-	-	-	-	15.0
inea	4.3	1.1	0.5	1.5	3.1	-	6.9	3.8	-	-	0.8	0.8	22.0
bya	-	-	-	-	-	-	-	-	-	-	-	-	2.4
rocco	11.4	0.2	0.3	0.6	0.2	2.4	5.6	-	1.0	0.8	0.2	1.0	22.7
geria	1.4	-	0.1	-	0.1	-	15.1	0.1	-	-	-	-	16.8
odesia & Nyasaland	-	0.1	0.1	0.1	0.1	-	1.6	-	-	-	-	-	2.0
negal, Mali & Mauritania	6.4	-	-	-	-	-	0.1	-	-	-	-	-	6.5
dan	4.3	-	-	-	-	1.3	6.0	5.0	0.1	-	-	-	16.7
go	-	-	-	-	-	-	-	-	-	-	-	-	-
nisia	1.0	-	-	-	-	-	5.7	-	-	-	-	-	6.7
anda	-	-	-	-	-	-	-	-	-	-	-	-	0.1
ion of South Africa	0.2	0.7	-	0.8	0.3	0.8	9.3	2.4	-	-	-	-	14.5
TOTAL	43.9	17.4	21.8	31.2	9.3	25.4	92.0	12.5	2.7	10.9	27.8	38.7	305.5
ASIA, FAR EAST & OCEANIA													
ghanistan	4.4	0.1	0.9	18.6	1.9	-	3.4	-	-	-	2.9	2.9	32.2
stralia	1.5	1.1	0.4	1.3	0.5	7.9	12.1	0.2	-	-	-	-	25.0
rma	2.8	-	0.7	1.1	-	-	30.8	-	-	-	-	-	35.4
ylon	25.5	0.2	0.7	0.2	0.3	0.3	5.2	-	-	-	-	-	32.4
ng Kong	96.3	3.9	3.3	2.2	0.1	25.6	81.1	0.1	2.8	-	-	-	215.4
dia	0.8	9.9	20.2	24.3	2.0	1.7	13.3	1.9	-	-	0.3	0.3	74.4
donesia	13.7	0.7	2.5	2.2	0.8	0.2	52.2	0.1	-	-	-	-	72.4
pan	16.5	8.3	-	1.7	21.1	39.6	1.4	0.3	17.3	15.2	3.6	18.8	125.0
laya & Singapore	24.9	2.7	1.2	0.5	0.5	7.4	26.6	0.1	0.1	-	-	-	64.0
w Zealand	-	-	-	-	-	-	-	-	-	-	-	-	3.0
kistan	3.4	0.6	1.5	1.5	0.3	0.9	3.6	0.6	2.5	-	-	-	14.9
uth Vietnam & Cambodia	2.2	0.5	0.3	1.2	1.0	0.6	8.5	0.1	-	-	-	-	14.4
iwan	-	-	-	-	-	-	-	-	-	-	-	-	2.2
ailand	-	-	-	0.5	-	-	5.0	-	-	-	-	-	5.5
TOTAL	192.0	28.0	31.7	55.3	28.5	84.2	243.2	3.4	22.7	15.2	6.8	22.0	716.2
GRAND TOTAL	920.8	243.5	343.5	289.8	141.3	831.8	767.0	66.4	314.6	141.5	308.8	450.3	4,409.9

h indicates negligible or known to be zero.
als may differ slightly from Table 17-2 due to difference in source.

SECTION 46

LESS DEVELOPED NATIONS

As indicated previously, Soviet Bloc trade serves many purposes. One aim is to procure badly needed Western technology, plants and equipment; another is to exert political pressure and extend Communist influence. The latter aim is most effectively realized in the less developed countries, where the USSR combines the extending of economic assistance with an aggressive expansion of trade often under conditions which are ostensibly quite favorable to the less developed participants. Many of these nations have political and economic structures that make them prime targets for Communist subversion.

The pressure to develop trade with politically vulnerable countries is such that the developing nations now have 6 percent of their trade with the Soviet Bloc while the Free World as a whole has 4 percent. Although the developing countries cannot offer the Soviet Bloc commodities of the same importance as those of highly industrialized countries, Bloc trade with the less developed areas has grown much faster (127 percent from 1955 to 1960) than Bloc trade with the industrialized nations (76 percent in the same period). In 1960, 46 percent of the Bloc trade was with the less developed countries. The Soviet Bloc generally receives agricultural commodities and raw materials. In turn, the Bloc sells them machinery, petroleum, food and ferrous metals. The benefit to the less developed countries lies largely in their ability to dispose of products in chronic surplus. In some cases, however, the Bloc has moved in with much fanfare to buy up a whole crop or substantial quantities of surplus products, only later to resell them on Free World markets in competition with countries from which they were originally purchased. Examples are cotton from Egypt and sugar from Cuba.

It is evident that the USSR is in a position to abrogate contracts or interrupt supplies unilaterally and arbitrarily. There is thus a potential weapon for exerting influence on customers who are dependent on Soviet Bloc trade for economic stability. Some examples in which the USSR has used trade considerations to exert political influence are as follows:

A. Israel

In 1956 the Soviet oil exporting agency concluded a contract with two Israeli companies to deliver oil to Israel.

On November 6, 1956, following the invasion of Suez, the Soviet Ministry of Foreign Trade cancelled without explanation the export license under which the oil shipments were to be made. Israeli claims for damages were rejected by the Soviet Foreign Trade Arbitration Commission. 1/

B. Finland

In 1958 the Soviet press made critical comments about the inclusion of some Conservatives in the Finnish Cabinet which had been set up on August 20 of that year. The USSR pointedly delayed negotiations for a trade agreement although the Finnish government showed an obvious desire to complete such agreements at an early date. Soviet orders with three major Finnish exporters were cancelled. On November 28, shipments of Soviet crude oil to Finland were cut off for the rest of the year. Throughout this period the Finnish Communists, echoed by the Soviet press and radio, emphasized the high unemployment rate in Finland and criticized the government for its inability to handle trade relations with the USSR. Largely as a result of the implied Soviet threat to curtail trade, the Conservatives withdrew from the Finnish Cabinet and the Cabinet was forced to resign. 2/

C. Yugoslavia

Moscow cancelled credits and sharply curtailed trade with Yugoslavia in the Spring of 1958 to show its displeasure at Tito's independent attitude. 3/

D. Cuba

In mid-1960 the USSR offered crude oil to Cuba and urged that the crude be forced upon refineries of outside ownership. Members of the Sino-Soviet Bloc offered to purchase Cuba's sugar exports and provide sizeable credits and technical assistance, thus encouraging the Cuban expropriation of industrial facilities and an almost complete severance of economic ties with the Free World. Some 80 percent of Cuba's trade is now with the Soviet Bloc in contrast to 2 percent before 1960. Thus the Cuban economy, having traditionally relied on exports of sugar to the United States, a market which has been lost, now depends to a high degree on her export outlets for this commodity to the Bloc (see Table 17-5). The capriciousness of this market may be best illustrated by the fact that in 1961 Poland and Czechoslovakia sold refined sugar in the British market at a price lower than that of raw sugar.

TABLE 17-5

CUBA - SUGAR PRODUCTION AND EXPORTS
1959-62
(Thousands of Metric Tons)

	1959	1960	1961	ESTIMATE 1962
Production	5,960 a/	5,860 a/	6,567 b/	5,178 b/
Exports to U. S.	2,754 c/	2,160 d/	0	0
Percent of Total Cuban Exports	53	43	0	0
Exports to Free World	5,680 e/	4,000 e/	1,993 f/	1,700 f/
Percent of Total Cuban Exports	98	80	34	28
Exports to Communist Bloc				
USSR				3,000
China				1,200
Eastern Europe				0
North Korea				100
TOTAL BLOC	120 e/	1,000 e/	3,796 f/	4,300 f/
PERCENT OF TOTAL CUBAN EXPORTS	2	20	66	72
Total Cuban Exports	5,800 e/	5,000 e/	5,789	6,000
Stocks at Year End	200 e/	1,000 g/	1,800 g/	1,000

a/ 4/
b/ 5/
c/ 6/
d/ 7/
e/ Estimate.
f/ 8/
g/ 9/

E. Greece

In late 1961 the USSR refused to deliver 40,000 tons of gasoline and oil which were ordered by Greece in October and which were urgently needed. After Moscow's refusal to deliver, Communist Rumania advised Athens that there had been a "mistake" and she would not be able to supply the fuel. [10/] It is not clear whether the Soviet action in this instance was meant to serve as some kind of "warning" to Greece or whether it was the result of economic considerations within the USSR. However, there was apparently influence on Rumania to conform with the Soviet action. The effect on the Greek economy could have been serious although Greece eventually obtained the required products from Western sources.

F. Uruguay

In 1958 Uruguay signed a barter agreement with the USSR to purchase $6 million of Soviet oil. These oil purchases were to be covered by Soviet purchases of Uruguayan wool, which at the time was in surplus supply. During the 1957-58 and 1958-59 wool seasons, the USSR emerged as Uruguay's principal wool buyer. But in the following season, the USSR bought practically no wool and the agreement collapsed. This withdrawal had a severe impact on the wool market, particularly since non-Communist buyers stayed out.

It has been suggested, according to the May, 1960 Economic Review of Uruguay published by the Economist Intelligence Unit, that the Soviet withdrawal was deliberate and calculated to strengthen its bargaining position in regard to the Uruguayan oil supply contracts that were being considered in 1960.

G. Other

In addition to the above examples, thare are numerous instances of Soviet Bloc trade with various less developed countries with no obvious economic advantage to the Bloc. While these transactions could conceivably be considered to be motivated by humanitarian feelings, it is also evident that they have placed the Bloc in a position to exert strong pressures on the governments involved. Examples are large and strategically-timed purchases of cotton from Egypt and Sudan, cocoa from Ghana, rubber from Ceylon, fish from Iceland and coffee from Colombia. Further, many Soviet offers to buy surplus commodities from developing countries are made to coincide with forthcoming elections in such countries in order to lend support to local leftist parties. An example is the offer made in 1958 to exchange oil for Brazilian coffee.

The political flavor of trade with the developing nations is underlined by the fact that Soviet exhibitions and participation in trade fairs held in the countries of Asia, Africa, and Latin America follow closely on the development of trade relations. These exhibitions are designed not only to advertise merchandise, but also to give glowing pictures of the Soviet political system and social, scientific, industrial, and cultural achievements. The political value of these exhibits has been described clearly by B. Borisov, Deputy Minister of Foreign Trade of the USSR, in reference to the exhibition in Havana:

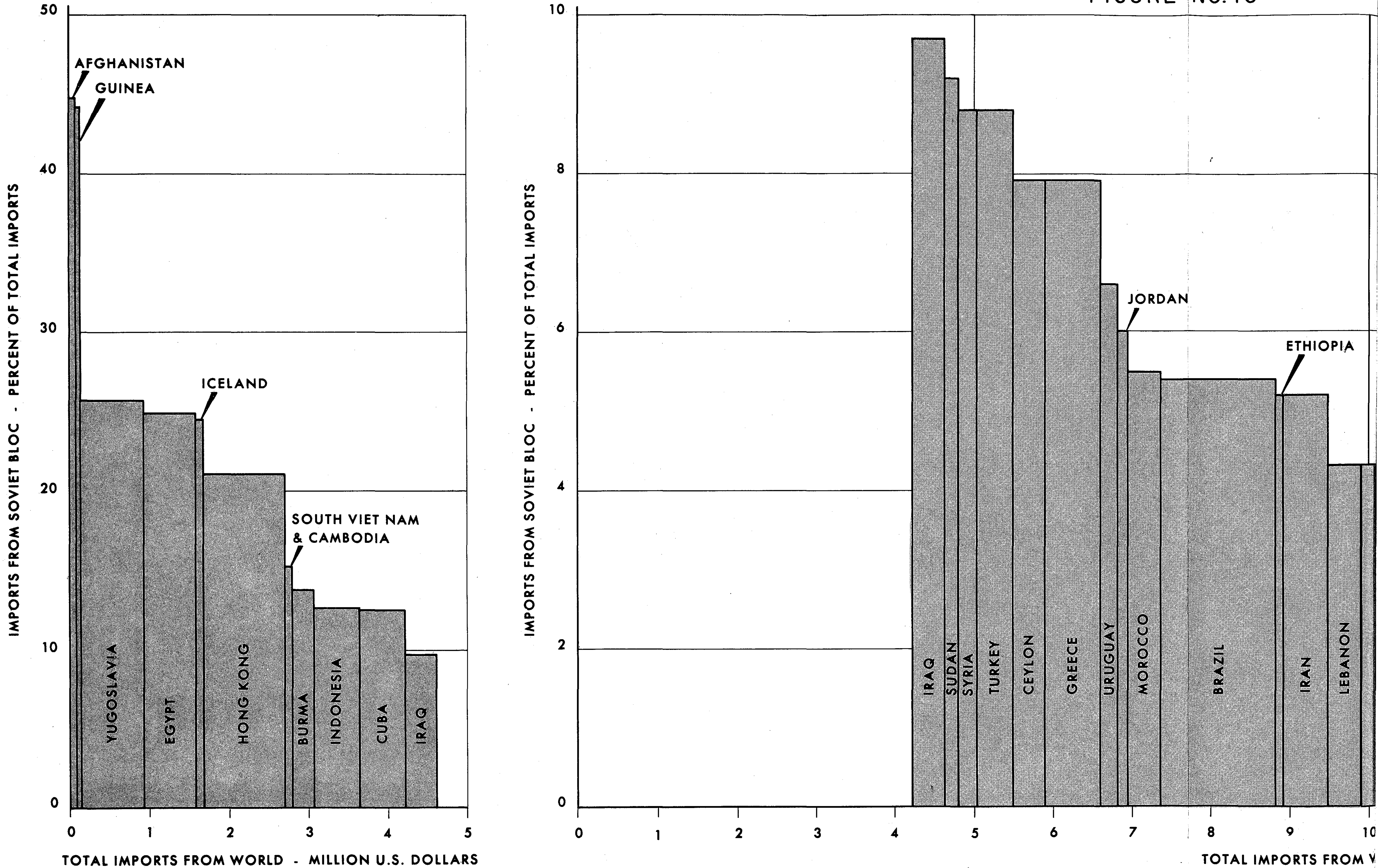
> "This exhibition opened the eyes of anyone who had been deceived or who was hesitant. It showed what the great land of the Soviets had achieved and explained how it was achieved. For many people it thus becomes increasingly clear by what road the Soviet people attained such huge progress in the fields of national economy, culture, science, and technology." 11/

The statistical significance of export outlets to the Soviet Bloc, opened up or increased as a result of the acceptance of Soviet Bloc trade in oil or other products, varies widely from country to country. The political and economic significance of reliance upon such outlets also varies widely. It can hardly be doubted, however, that any substantial reliance by a Free World country upon trade with the Soviet Bloc, the governments of which are in a position to exercise complete control over foreign trade, creates a threat to the security, political independence, and economic health of that country.

Some of the less developed countries have a very high percentage of their trade with the Bloc, as shown in Figure No. 16. It has already been pointed out that Cuba is now inextricably committed to the Bloc, both politically and economically. Among other developing nations, Afghanistan and Guinea are highly dependent, each having more than 40 percent of her imports from members of the Communist group. In total volume, Egypt and Yugoslavia are the largest traders with the Soviet Bloc among the developing countries. In 1960, 25 percent of Egypt's total imports, or $161.2 million worth, came from the Bloc, and 44 percent, or $244.3 million, of her exports were to the Bloc. These are highly significant numbers especially in view of the economic and strategic implications of Egypt's control of the Suez Canal, and her position as one of the most important Arab countries from the standpoint of economic development and ideological leadership. India, an ideological leader in Asia, also has a large volume of trade with the Bloc. Iceland and Greece are important from the point of view of Western military strategy.

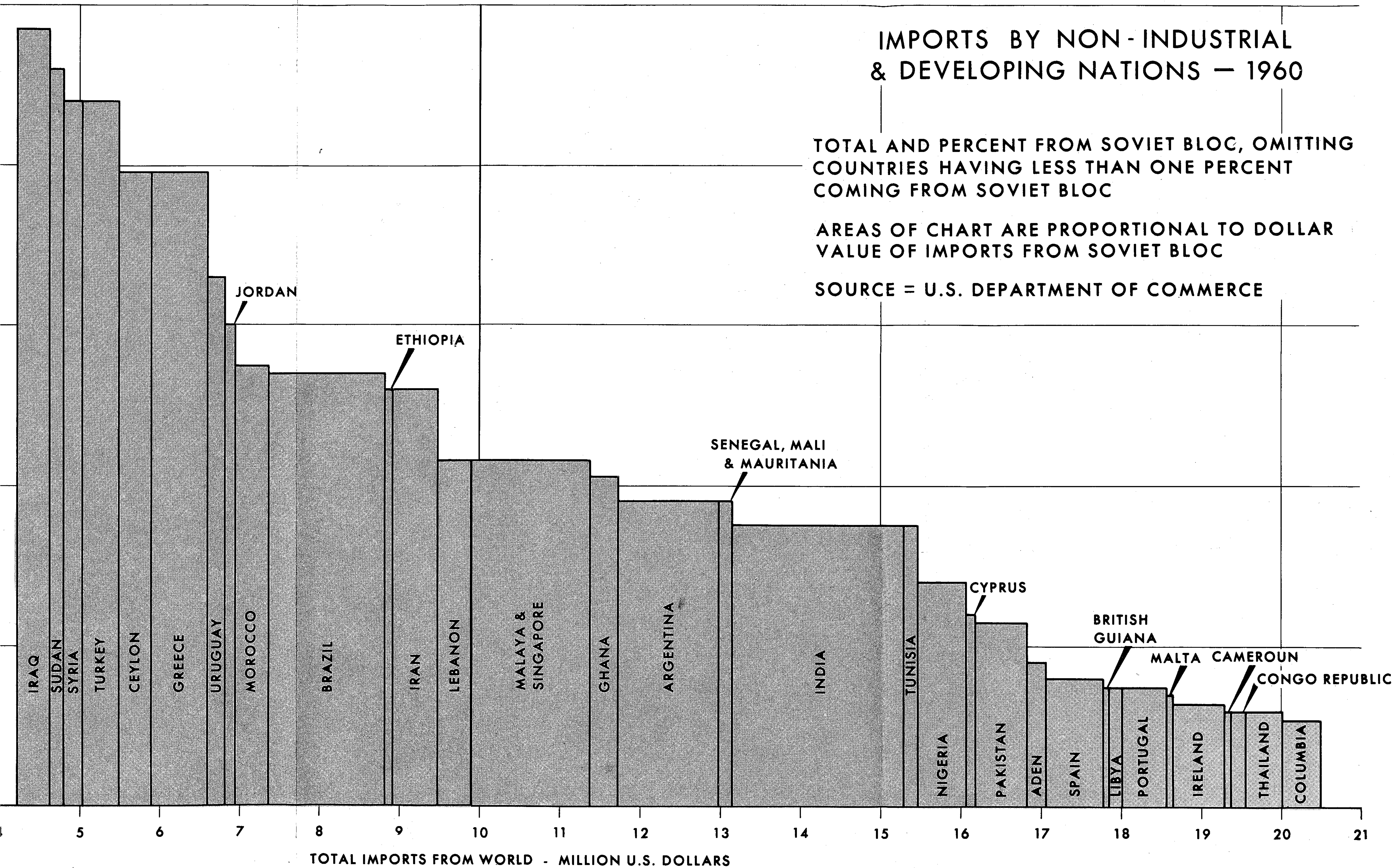
It should be borne in mind that trade is only one aspect of Soviet economic expansion in the developing countries. Others are grants of credits and other forms of assistance, training and technical assistance by Soviet specialists, and outright gifts and free services. By mid-1961 the Bloc had extended a total of $5.9 billion in economic and military aid to 26 less-developed countries. 12/

FIGURE NO. 16



50
40
30
20
10
0
IMPORTS FROM SOVIET BLOC - PERCENT OF TOTAL IMPORTS
AFGHANISTAN
GUINEA
ICELAND
SOUTH VIET NAM
& CAMBODIA
YUGOSLAVIA
EGYPT
HONG KONG
BURMA
INDONESIA
CUBA
IRAQ
0
1
2
3
4
5
TOTAL IMPORTS FROM WORLD - MILLION U.S. DOLLARS
10
8
6
4
2
0
IMPORTS FROM SOVIET BLOC - PERCENT OF TOTAL IMPORTS
JORDAN
ETHIOPIA
IRAQ
SUDAN
SYRIA
TURKEY
CEYLON
GREECE
URUGUAY
MOROCCO
BRAZIL
IRAN
LEBANON
0
1
2
3
4
5
6
7
8
9
TOTAL IMPORTS FROM

FIGURE NO. 16


IMPORTS BY NON-INDUSTRIAL & DEVELOPING NATIONS — 1960
TOTAL AND PERCENT FROM SOVIET BLOC, OMITTING COUNTRIES HAVING LESS THAN ONE PERCENT COMING FROM SOVIET BLOC
AREAS OF CHART ARE PROPORTIONAL TO DOLLAR VALUE OF IMPORTS FROM SOVIET BLOC
SOURCE = U.S. DEPARTMENT OF COMMERCE
IRAQ
SUDAN
SYRIA
TURKEY
CEYLON
GREECE
URUGUAY
JORDAN
MOROCCO
BRAZIL
ETHIOPIA
IRAN
LEBANON
MALAYA & SINGAPORE
GHANA
ARGENTINA
SENEGAL, MALI & MAURITANIA
INDIA
TUNISIA
NIGERIA
CYPRUS
PAKISTAN
ADEN
SPAIN
BRITISH GUIANA
LIBYA
PORTUGAL
MALTA
IRELAND
CAMEROUN
CONGO REPUBLIC
THAILAND
COLUMBIA
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
TOTAL IMPORTS FROM WORLD - MILLION U.S. DOLLARS

SECTION 47

INDUSTRIALIZED COUNTRIES

The Sino-Soviet economy turns to other Free World countries to fill out its requirements for the rapid industrial growth which has been decreed. Tables 17-6 and 17-7 show the 1960 Bloc imports and exports of those Free World nations which are supplying a major part of these needs. On Table 17-6 the exports to the Bloc of metals, metal shapes, transportation equipment, machinery, complete plants and other manufactured goods are segregated to show the importance of this segment of trade to the USSR and her satellites.

The main areas of interest to the Bloc in these categories contain those items which are the product of the advanced technology of the industrialized countries. Particularly desirable from the Communist point of view are complete plants which represent an import of technology that can be duplicated directly and thus multiply many-fold the yield from a relatively small purchase. The following items have been singled out as being of especial significance: complete petrochemical and synthetic plants, electronic equipment for communications and control, precision and highly automatic machine tools, construction machinery, industrial handling equipment, carbon steel and alloy sheet and strip, modern cold-rolling mills for sheet and strip steel, electric power generation and transmission equipment, precision bearings, rail and ocean transport equipment, complete tire plants, and large diameter pipe and other equipment needed for the production and transportation of oil. Many of these items--for example, equipment used for an expanding oil transportation network, have obvious potential military value.

The exporting nations buy from the Bloc large amounts of food, crude materials and fuels as shown on Table 17-7. More complete information on the types of products imported from and exported to the Bloc by Free World trading countries has been given in Tables 17-3 and 17-4 above.

The rates of post-war growth in exports to the Bloc from selected industrialized countries are shown in Figure No. 17. Growth rates are highest for West Germany, Japan, France, Austria, and Italy. Absolute values in 1960 are shown in the right hand margin. West Germany is by far the largest exporter to the Bloc, with $765 million worth of exports in 1960. The United

Kingdom, France and Italy follow among the industrialized European nations. Figure No. 18 shows the Bloc trade as a percent of total trade for these same countries for the years 1948 through 1960. Since 1953 the proportion that Bloc trade accounts for in total export trade has increased for all countries shown except Sweden and Finland.

In another section of this report, the controls on the types of equipment to be exported by the Free World to the Bloc are shown to be relatively minor. Except for the United States, most of the countries of the West are denying to the Bloc only products of immediate and obvious strategic and military importance. It would appear evident that the Western industrialized countries, which know themselves to be threatened militarily and subversively by the Sino-Soviet Bloc, are defeating their own ends by contributing to the economic and military strength of the Communists.

Most of the countries shown in Table 17-6 have certain interests which are importantly concerned with maintaining export outlets to the Soviet Bloc. This situation places the Bloc in the position of being able to exert political influence in the supplying nations. Enterprises involved in supplying products to the Bloc can be undermined by political decision in the Soviet Union to close these markets. If these markets were closed, the enterprises probably would exert pressure on their governments to seek a reopening of these trade outlets. Since the markets would have been closed for political reasons, regaining access to them might well involve concessions that would be advantageous to the Soviets.

TABLE 17-6

VALUE OF EXPORTS TO SOVIET BLOC
FROM SELECTED INDUSTRIALIZED COUNTRIES a/ - 1960
($U.S. Million)

COUNTRY	TOTAL EXPORTS TO THE BLOC	EXPORTS OF METALS, METAL SHAPES, TRANSPORT EQUIPMENT, MACHINERY, PLANTS OTHER MANUFACTURED GOODS	
		AMOUNT	PERCENT OF TOTAL
Austria	167	141.0	84
Belgium Luxembourg	141	102.8	73
France	275	240.4	87
West Germany	765	613.5	80
Italy	212	130.3	61
Japan	73	61.8	85
Sweden	124	76.1	61
United Kingdom	360	234.7	65
United States	193	47.5	25

a/ 1/

TABLE 17-7

VALUE OF IMPORTS FROM THE SOVIET BLOC
BY SELECTED INDUSTRIALIZED COUNTRIES a/ - 1960
($U.S. Million)

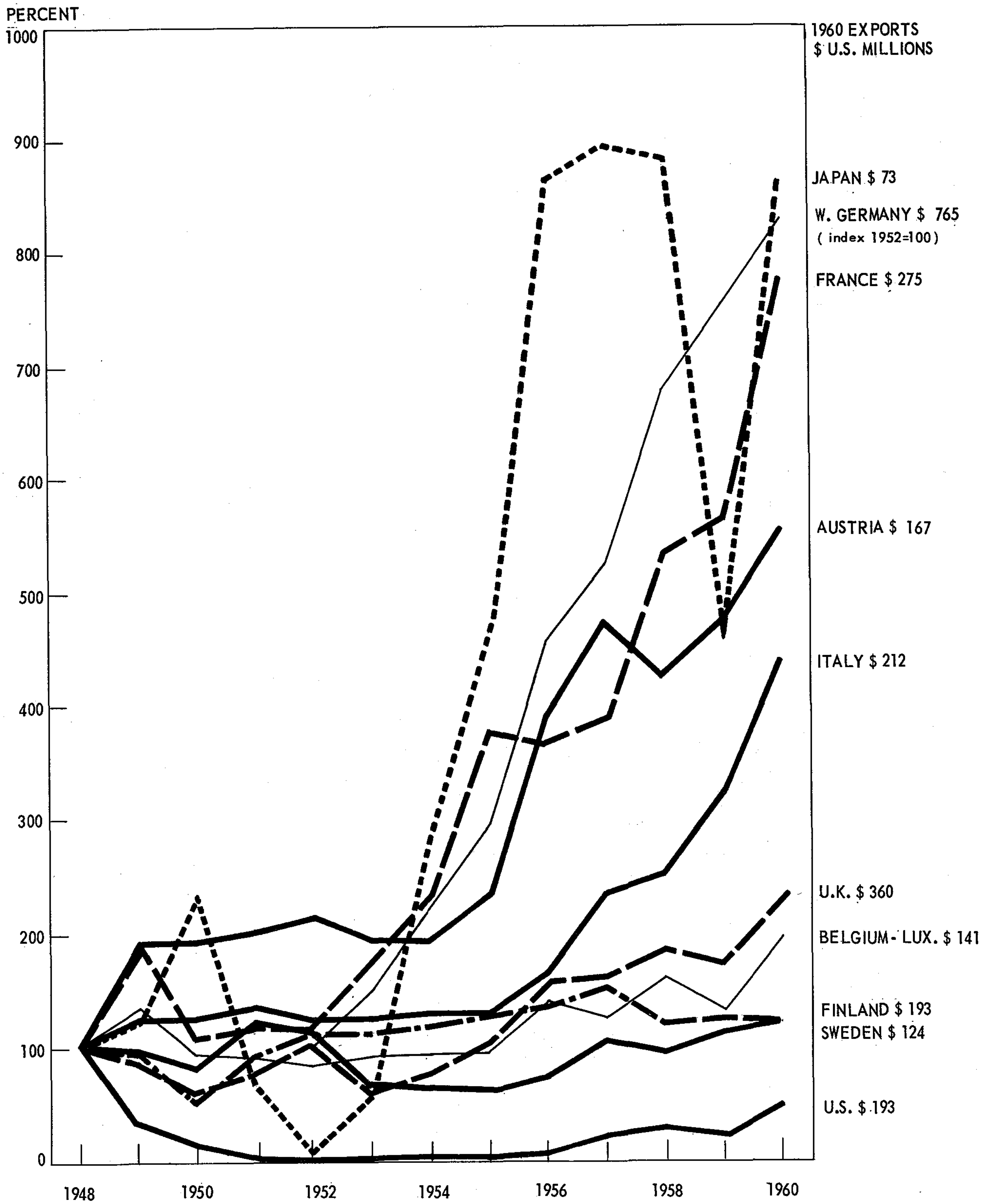
COUNTRY	TOTAL IMPORTS FROM THE BLOC	FOODS, CRUDE MATERIALS, FUELS (INCLUDING PETROLEUM)	
		AMOUNT	PERCENT OF TOTAL
Austria	164	129.5	79
Belgium Luxembourg	88	47.5	54
France	177	143.0	81
West Germany	719	504.9	70
Italy	289	193.9	67
Japan	125	92.2	74
Sweden	127	76.0	60
United Kingdom	459	352.8	77
United States	84	47.5	57

a/ 2/

Figure No. 17

EXPORTS TO SOVIET BLOC

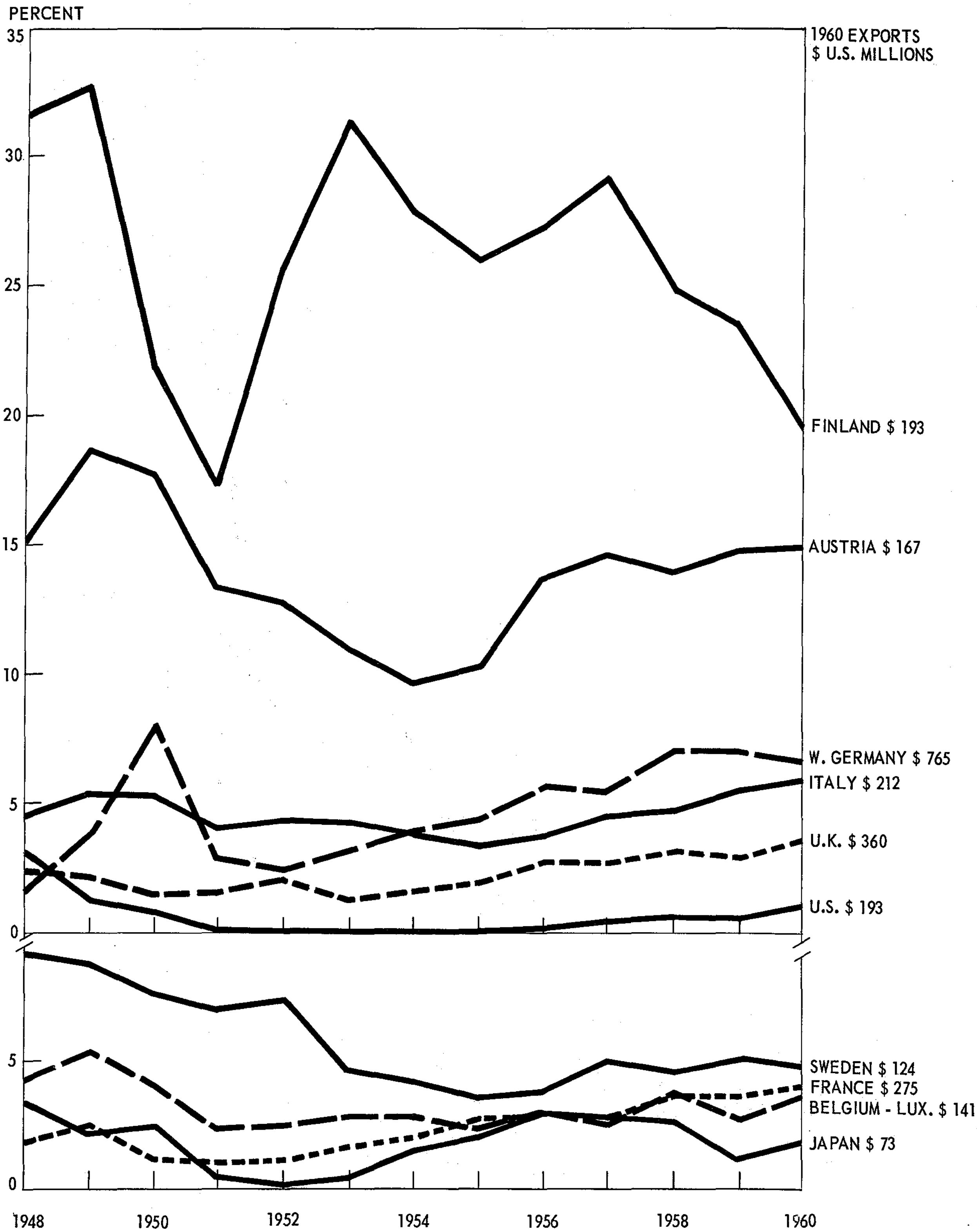
Index 1948=100



SOURCE: U.S. DEPARTMENT OF COMMERCE, INTERNATIONAL ECONOMIC ANALYSIS DIVISION
BUREAU OF FOREIGN COMMERCE - VALUE SERIES.

Figure No. 18

EXPORTS TO SOVIET BLOC AS PERCENT OF TOTAL EXPORT TRADE



SOURCE: U.S. DEPARTMENT OF COMMERCE, INTERNATIONAL ECONOMIC ANALYSIS DIVISION
BUREAU OF FOREIGN COMMERCE - VALUE SERIES.

CHAPTER XVIII

PETROLEUM TRADE

CHAPTER XVIII

PETROLEUM TRADE

SECTION 48

CONSUMING COUNTRIES

From Lenin down to the present day, the Communists have looked upon the private international oil industry as a major symbol of the free enterprise system and of the economic strength of the Free World. As such, the continuing expansion of the private oil companies poses a threat to the spread of their own ideology of state control.

An article in the Soviet publication International Affairs went further in clarifying the aims of the Communists towards the Free World oil industry. It stated:

> "It should be borne in mind that oil concessions represent, as it were, the foundation of the entire edifice of Western political influence in the (less developed) world, of all military bases and aggressive Blocs. If this foundation cracks, the entire edifice may begin to totter and then come tumbling down."

Thus, the Communists are not out simply to sell oil, but among other things to disrupt, undermine and, if possible, destroy the position of the private oil industry.

The Soviet Union is using every means to encourage state control over oil in Free World countries, and to incite the leaders of developing nations against the private oil industry. Facilities have already been expropriated in Ceylon and Cuba and the industry is under heavy pressure in many other countries as result of Soviet offers of oil aid. The Soviet Union is sending out technicians and making loans to any country willing to promote state development and distribution of oil. Countries which have accepted such aid range from Afghanistan in the Far East to Argentina in the Western Hemisphere. Government oil companies in turn become large customers of Soviet Bloc oil. As a result Communist influence is being extended into important industries and key areas.

The trading methods of the Communists--state trading on the basis of government-to-government barter agreements--weaken seriously the basis for continued private trading in oil. State trading is by its nature discriminatory and destructive of free enterprise, and when conducted on a massive scale and by countries opposed to private ownership, it becomes an even more powerful means of weakening private oil company operations.

The impact of the Soviet attack on the private oil industry goes beyond its immediate implications to the companies involved. It is of great importance to the governments and peoples of the Free World. Reliance on an appreciable supply of Soviet oil provides the possibility of a strategic advantage to the Communists in times of crisis when a sudden cut-off would require substantial efforts by the Free World oil industry to restore normal lines of supply.

A. Present Scope of Trade

In 1960 the value of Free World Petroleum imports from the Soviet Bloc was $460 million. This represented 11 percent of all Free World imports from the Bloc, by far the largest item purchased from the Communists by the West. As shown in Table 18-1, petroleum represents an increasing portion of trade. Oil has grown from 2 percent of Free World imports from

TABLE 18-1

VALUE OF PETROLEUM COMPONENT OF FREE WORLD IMPORTS FROM THE BLOC
1952 - 1960

		TOTAL SOVIET BLOC (INCL. CHINA)			EUROPEAN SATELLITES			U S S R		
YEAR	SOURCE a/	TOTAL TRADE ($US MILLION)	PETROLEUM ($US MILLION)	PERCENT	TOTAL TRADE ($US MILLION)	PETROLEUM ($US MILLION)	PERCENT	TOTAL TRADE ($US MILLION)	PETROLEUM ($US MILLION)	PERCENT
1952	8	1,633.9	25.7	1.6	794.6	15.8	2.0	468.3	9.9	2.1
1953	8	1,631.1	56.4	3.5	807.9	40.6	5.0	381.8	15.8	4.1
1954	9	1,835.6	116.9	6.4	952.7	60.8	6.4	500.5	56.1	11.2
1955	11	2,421.3	142.7	5.9	1,284.1	72.1	5.6	640.3	70.6	11.0
1956	12	2,944.8	176.4	6.0	1,473.0	76.7	5.2	814.3	99.7	12.2
1957	13	3,203.4	277.0	8.6	1,514.2	95.0	6.3	1,042.3	181.2	17.4 b/
1958	15	3,509.8	309.0	8.8	1,690.5	100.6	6.0	1,045.5	207.7	19.9 b/
1959	15	3,729.2	367.7	9.9	1,773.6	110.8	6.2	1,237.1	256.3	20.7 b/
1960	c/	4,275.8	460.4	10.8	2,103.3	116.2	5.5	1,395.0	343.8	24.6 b/

a/ Data from Annual Battle Act Reports to Congress of the Secretary of State on Mutual Defense Assistance Control Act of 1951. Numbers refer to Report Numbers.
b/ Official Soviet statistics report percentages for value of oil exported in relation to value of total exports (f.o.b.) to Free-World at variance with these figures derived from Free-World import data. See Table 3-72
c/ 2/

the USSR in 1952 to almost 25 percent in 1960, and in the same period from 2 percent of imports from all the Bloc countries to 11 percent. Without doubt the Communists have seized on petroleum as a highly merchantable commodity that they can barter for much needed Western equipment and technology as well as for the more nebulous commodity of political influence.

The 1955 to 1961 pattern of the rising flow can be traced in Table 18-2. Here it is seen that Communist oil to the West has increased to 30.5 million tons in 1961, at an average growth rate of 32 percent per year since 1955. While petroleum exports from the satellites have increased during this period, their proportion of total oil exports from the entire Bloc has dropped from 30 percent in 1955 to 15 percent in 1961. In fact, since the satellite countries are now large net importers from the USSR, the growth of Bloc exports may be considered as being made possible by the increasing availability of oil in the Soviet Union.

The major portion of the increase in available Communist oil is flowing to Free Europe. In 1961, it absorbed 64 percent of the supply. This percentage is down from earlier years due in large part to the development of several excellent outside customers, notably Japan, Egypt and Cuba. Seepage into the Western Hemisphere has been small except for captive Cuba. It is significant to note that 80 percent of the volume of Communist oil is absorbed by a handful of customers--Italy, West Germany, Cuba, Japan, Sweden, Egypt and Finland.

While the USSR supplies both crude and products to the Western nations, the satellites have thus far exported only products. Fifty-three percent of the total Bloc exports were crude in 1961. The proportion has been increasing, probably since it represents the minimum amount of capital and equipment investment and is most readily saleable in large quantities.

B. <u>Means By Which Bloc Petroleum Enters Commerce</u>

The sale of petroleum, as of other Soviet Bloc products, is carried out largely under bilateral trade agreements negotiated on a state-to-state basis. These provide a framework for continuing trade. They signify the intention of the two countries to carry out trade in specified commodities and amounts and they assure that the government will, when necessary, provide

TABLE 18-2a

TOTAL SOVIET BLOC PETROLEUM EXPORTS
TO FREE WORLD BY COUNTRY OF DESTINATION a/
1955-1957
(Thousand Metric Tons)

DESTINATION	1955 USSR	1955 SATELLITES	1955 TOTAL	1956 USSR	1956 SATELLITES	1956 TOTAL	1957 USSR	1957 SATELLITES	1957 TOTAL
WESTERN HEMISPHERE									
Argentina	636.9	-	636.9	-	-	-	-	-	-
Brazil	-	-	-	-	-	-	-	-	-
Uruguay	-	5.0	5.0	-	-	-	-	-	-
TOTAL WESTERN HEMISPHERE	636.9	5.0	641.9	-	-	-	-	-	-
FREE EUROPE									
Austria	37.4	139.0	176.4	26.1	91.0	117.1	57.4	182.0	239.4
Belgium	30.3	120.0	150.3	30.5	120.0	150.5	0.7	105.0	105.7
Denmark	2.1	40.0	42.1	0.6	5.0	5.6	22.7	5.0	27.7
Finland	612.5	300.0	912.5	1,011.8	260.0	1,271.8	1,214.0	155.0	1,369.0
France	269.3	165.0	434.3	408.9	170.0	578.9	551.3	260.0	811.3
West Germany	5.3	255.0	260.3	142.7	410.0	552.7	797.4	725.0	1,522.4
Greece	94.5	135.0	229.5	224.1	95.0	319.1	302.5	65.0	367.5
Iceland	283.3	-	283.3	258.9	-	258.9	299.8	-	299.8
Italy	183.3	70.0	253.3	500.4	30.0	530.4	502.3	145.0	647.3
Netherlands	10.3	-	10.3	15.1	-	15.1	0.2	-	0.2
Norway	35.5	20.0	55.5	26.1	85.0	111.1	146.8	50.0	196.8
Portugal	-	-	-	-	-	-	-	-	-
Sweden	725.6	245.0	970.6	694.2	80.0	774.2	536.4	20.0	556.4
Switzerland	0.1	35.0	35.1	1.2	25.0	26.2	128.6	30.0	158.6
United Kingdom	37.4	-	37.4	26.1	5.0	31.1	57.4	5.0	62.4
Yugoslavia	208.6	5.0	213.6	331.9	55.0	386.9	407.4	70.0	477.4
TOTAL FREE EUROPE	2,535.5	1,529.0	4,064.5	3,698.6	1,431.0	5,129.6	5,024.9	1,817.0	6,841.9
OTHER EASTERN HEMISPHERE									
Afghanistan	21.1	-	21.1	27.4	-	27.4	34.3	-	34.3
Algeria	35.3	-	35.3	93.2	-	93.2	166.3	-	166.3
Ethiopia	-	-	-	-	-	-	-	-	-
Ghana	-	-	-	-	-	-	-	-	-
Guinea	-	-	-	-	-	-	-	-	-
India	-	-	-	-	-	-	-	-	-
Iran	0.5	-	0.5	0.2	-	0.2	0.3	-	0.3
Japan	-	-	-	-	-	-	-	-	-
Lebanon	-	-	-	-	-	-	11.2	-	11.2
Morocco	-	-	-	3.0	-	3.0	33.3	-	33.3
Syria	-	-	-	26.0	5.0	31.0	30.2	5.0	35.2
Tunisia	-	-	-	-	-	-	-	-	-
Turkey	0.6	-	0.6	5.7	-	5.7	4.7	-	4.7
United Arab Republic	329.5	245.0	574.5	920.7	340.0	1,260.7	1,072.4	81.0	1,153.4
TOTAL OTHER EASTERN HEMISPHERE b/	387.0	245.0	632.0	1,076.2	345.0	1,421.2	1,352.7	86.0	1,438.7
TOTAL FREE WORLD c/	4,039.2	1,779.0	5,818.2	5,150.9	1,776.0	6,926.9	6,386.1	1,903.0	8,289.1

a/ Data for the USSR taken from the official Soviet Trade Handbooks; data for the Satellites represent Committee estimates.

b/ Although it is known that exports were made to Israel in 1955 and 1956, they are not recorded in the Soviet Trade Handbooks used in this table.

c/ Totals include small amounts of products not accounted for in Soviet Handbook export figures to individual countries.

TABLE 18-2b

TOTAL SOVIET BLOC PETROLEUM EXPORTS
TO FREE WORLD BY COUNTRY OF DESTINATION a/
1958-1960
(Thousand Metric Tons)

DESTINATION	1958 USSR	1958 SATELLITES	1958 TOTAL	1959 USSR	1959 SATELLITES	1959 TOTAL	1960 USSR	1960 SATELLITES	1960 TOTAL
WESTERN HEMISPHERE									
Argentina	911.3	170.0	1,081.3	444.8	20.0	464.8	-	-	-
Brazil	-	-	-	59.4	-	59.4	161.4	-	161.4
Cuba	-	-	-	-	-	-	2,164.8	-	2,164.8
Uruguay	214.4	-	214.4	500.7	-	500.7	71.4	-	71.4
TOTAL WESTERN HEMISPHERE	1,125.7	170.0	1,295.7	1,004.9	20.0	1,024.9	2,397.6	-	2,397.6
FREE EUROPE									
Austria	60.5	320.0	380.5	526.7	335.0	861.7	605.2	430.0	1,035.2
Belgium	72.9	135.0	207.9	194.2	310.0	504.2	203.1	205.0	408.1
Denmark	38.7	5.0	43.7	96.5	15.0	111.5	153.4	15.0	168.4
Finland	1,233.7	35.0	1,268.7	1,856.3	40.0	1,896.3	2,127.9	110.0	2,237.9
France	710.7	300.0	1,010.7	807.6	430.0	1,237.6	785.2	430.0	1,215.2
West Germany	561.7	825.0	1,386.7	1,086.7	1,090.0	2,176.3	2,007.0	1,190.0	3,197.0
Greece	362.0	76.0	438.0	424.0	65.0	489.0	947.5	85.0	1,032.5
Iceland	332.2	-	332.2	365.4	-	365.4	339.2	-	339.2
Italy	1,082.0	100.0	1,182.0	3,035.9	110.0	3,145.9	4,702.5	120.0	4,822.5
Netherlands	103.0	-	103.0	47.9	10.0	57.9	40.1	10.0	50.1
Norway	158.0	45.0	203.0	263.3	140.0	403.3	249.1	115.0	364.1
Portugal	49.4	-	49.4	-	-	-	62.7	-	62.7
Sweden	870.4	55.0	925.4	1,451.4	65.0	1,516.4	1,968.3	125.0	2,093.3
Switzerland	-	45.0	45.0	39.4	55.0	94.4	28.5	35.0	63.5
United Kingdom	37.8	5.0	42.8	101.8	10.0	111.8	283.4	10.0	293.4
Yugoslavia	382.9	NA	382.9	438.2	80.0	518.2	456.1	70.0	526.1
Unknown	-	-	-	-	-	-	-	392.0	392.0
TOTAL FREE EUROPE	6,055.9	1,946.0	8,001.9	10,734.9	2,755.0	13,489.9	14,959.2	3,342.0	18,301.2
OTHER EASTERN HEMISPHERE									
Afghanistan	41.8	-	41.8	47.6	-	47.6	48.3	-	48.3
Algeria	38.0	-	38.0	25.6	-	25.6	61.5	-	61.5
Ethiopia	-	-	-	-	-	-	0.5	-	0.5
Ghana	-	-	-	-	-	-	0.1	-	0.1
Guinea	-	-	-	0.1	-	0.1	28.9	-	28.9
India	-	-	-	-	-	-	23.0	-	23.0
Iran	0.3	-	0.3	0.3	-	0.3	0.5	-	0.5
Japan	11.1	-	11.1	155.1	-	155.1	1,403.5	-	1,403.5
Lebanon	-	-	-	66.0	-	66.0	86.3	-	86.3
Morocco	30.0	-	30.0	64.6	-	64.6	43.5	-	43.5
Syria	270.8	75.0	345.8	448.9	40.0	488.9	273.3	40.0	313.3
Tunisia	17.9	-	17.9	13.7	-	13.7	-	-	-
Turkey	0.2	-	0.2	0.7	-	0.7	6.6	-	6.6
United Arab Republic	1,941.8	NA	1,941.8	1,903.0	257.0	2,160.0	1,335.7	200.0	1,535.7
TOTAL OTHER EASTERN HEMISPHERE	2,351.9	75.0	2,426.9	2,725.6	297.0	3,022.6	3,312.3	240.0	3,552.3
TOTAL FREE WORLD b/	9,581.4	2,191.0	11,772.4	14,553.5	3,072.0	17,625.5	20,723.4	3,582.0	24,305.4

a/ Data for the USSR taken from the official Soviet Trade Handbooks; data for the Satellites represent Committee estimates.

b/ Totals include small amounts of products not accounted for in Soviet Handbook export figures to individual countries.

TABLE 18-2-c

TOTAL SOVIET BLOC PETROLEUM EXPORTS
TO FREE WORLD BY COUNTRY OF DESTINATION *
1961
(Thousand Metric Tons)

DESTINATION	USSR	SATELLITES	TOTAL	PERCENT OF LOCAL DEMAND
WESTERN HEMISPHERE				
Brazil	450	60	510	4
Cuba	3,900	-	3,900	100
Uruguay	50	-	50	4
TOTAL	4,400	60	4,460	
FREE EUROPE				
Austria	200	470	670	21
Belgium	200	140	340	3
Denmark	200	20	220	3
Finland	2,200	185	2,385	78
France	700	450	1,150	3
West Germany	2,500	1,625	4,125	10
Greece	600	300	900	35
Iceland	300	-	300	88
Italy	6,000	330	6,330	22
Netherlands	50	-	50	-
Norway	100	150	250	7
Portugal	-	-	-	-
Spain	50	50	100	2
Sweden	2,300	265	2,565	19
Switzerland	50	50	100	2
United Kingdom	100	15	115	-
Yugoslavia	100	-	100	10
TOTAL	15,650	4,050	19,700	8
OTHER EASTERN HEMISPHERE				
Afghanistan	(a)	-	(a)	-
Algeria	(a)	-	(a)	-
Ethiopia	(a)	-	(a)	-
Ghana	(a)	-	(a)	-
Guinea	(a)	-	(a)	-
India	(a)	-	(a)	-
Iran	(a)	-	(a)	-
Japan	2,700	40	2,740	7
Lebanon	(a)	-	(a)	-
Morocco	(a)	-	(a)	-
Syria	(a)	-	(a)	-
Tunisia	(a)	-	(a)	-
Turkey	(a)	-	(a)	-
Egypt	2,000	350	2,350	48
Others a/	1,250	-	1,250	
TOTAL	5,950	390	6,340	
TOTAL FREE WORLD	26,000	4,500	30,500	

* Committee estimates.
a/ Estimate includes combined imports of countries indicated by (a).

enabling licenses. Actual consummation of the purchase and sale depends on the completion of contracts by the Communist trading agency and the customers involved. In some cases the contracts have been known to have been signed before the trade agreements were ratified. In other cases, however, oil importers are often under heavy pressure from their own governments to take Soviet oil because of the government's desire to increase exports and domestic employment through East-West trade. Table 18-3 summarizes current agreements involving oil or petroleum technical assistance. In many countries non-integrated private organizations participating in one or two phases of the operation have become increasingly prominent. They may be only marketing, refining or refining-marketing companies. Such refining companies not owning their own crude production are prime customers for Bloc crude. The non-integrated marketer is also a highly prospective customer for Soviet Bloc products.

Of course, not all of the oil business in the Free World is conducted by private companies. Many countries have set up nationalized oil concerns that may or may not have monopoly status in that country. Many of these concerns, if dependent on imports of either crude or products for supplies, have also been good customers for Bloc oil.

Table 18-4 lists Soviet Bloc crude oil sales by country and type of purchaser for 1961. Of particular interest is the fact that 63 percent of Soviet Bloc crude oil sales (where purchasers were known) were made to Free World government oil companies. Almost all of the remainder of the crude, 35 percent, was processed by non-integrated refineries.

Table 18-5 lists Soviet Bloc product sales by country and type of purchaser for the same year. Government oil companies accounted for 22 percent of those sales where purchasers were known, whereas the non-integrated marketers and large consumers accounted in total for 63 percent. Integrated companies are purchasing about 15 percent of known total product sales. Almost half of the latter quantity is accounted for in Finland where the government tightly controls supplies brought into the country.

TABLE 18-3

CURRENT FREE WORLD AGREEMENTS WITH SOVIET BLOC COUNTRIES INVOLVING OIL/TECHNICAL ASSISTANCE TO THE OIL INDUSTRY

NO.	FREE WORLD COUNTRIES	BLOC COUNTRIES	NATURE OF AGREEMENT AND PERIOD COVERED	DATE OF SIGNING	DETAILS OF AGREEMENT AND REMARKS
1.	AFGHANISTAN	USSR	Economic and Technical Co-operation Period of Afghan 2nd 5-Year Plan 1962-66	October, 1961	Includes provision for Soviet assistance in building 'enterprises of the oil and chemical industries' and in geological surveys.
2.	AFGHANISTAN	USSR	Trade and Payments agreement 1962 and deliveries of consumer goods to 1966	December, 1961	Includes Soviet exports of manufacturers and oil products against agricultural products.
3.	ARGENTINA	USSR	Loan - 1961-62	July, 1961	$100 million Soviet credit to Y.P.F. for purchase of oil equipment and machinery.
4.	AUSTRIA	USSR	Protocol to long term trade agreement 1961-65 covering trade in 1962	December, 1961	Russian deliveries include:- Crude oil 500,000 tons Gasoline 40,000 " Fuel oil 100,000 " Paraffin 600 " Austrian deliveries include 1 million meters of thin wall seamless carbon steel tubes, two "oil de-salting plants". $750,000 "pipes for the oil industry and other tubes".
5.	AUSTRIA	USSR	Reparations agreement	(amended) July, 1960	Austria to deliver to USSR 500,000 tons crude per annum up to July, 1964.
6.	AUSTRIA	RUMANIA	Trade agreement for 5 year period	June, 1961	Provides for increased Austrian imports of oil products. Quota for first year (May, 1961 - April, 1962). $3 million.
7.	BRAZIL	USSR	Trade agreement 1960-62	December, 1959	Various amendments and protocols have apparently been made to this original agreement, and the amounts of oil to be exported in 1962 are not clear. The quantity will probably include diesel oil and crude. The Russians have also agreed to build a shale gas refining plant in Brazil, but it is not clear whether or not a separate agreement covers this.
8.	BRAZIL	ALBANIA	Trade and payments agreement. Period unspecified	April/May, 1961	Albanian exports in 'first year' were to include 50,000 tons 'crude oil' and 12,000 tons 'natural and petroleum pitch'. It is not known if any movements have taken place.
9.	BRAZIL	RUMANIA	Trade and payments agreement for five years	May, 1961	Rumanian exports include oil products. First year quotas were:- Gasoline 100,000 tons Kerosine 200,000 " Gas oil 200,000 " Fuel oil 80,000 " Liquid gas 40,000 " Asphalt 10,000 " Luboils 20,000 " Caustic soda 5,000 "
10.	CEYLON	USSR	Trade agreement 1962-64 Contract for oil supplies for five year period	February, 1962 December, 1961	The contract covers Soviet oil product exports of a minimum of 1,250,000 tons over five years in exchange for agricultural products. The first import took place in March, 1962, and the quota for the first year is expected to be about 200,000 tons. Products will include gasoline, kerosine, and diesel.
11.	CEYLON	RUMANIA	Trade agreement Period unspecified	February, 1962	Envisages Rumanian export of petroleum products against agricultural products.
12.	CUBA	USSR	Trade agreement and 1962 Protocol to this agreement	February, 1960 January, 1962	Soviet exports in 1962 will include crude oil and products but no quantities have been announced.
13.	CUBA	USSR			Nature of agreement unknown, but there is presumably a technical co-operation agreement, as under this the USSR is to build a 40,000 b/d refinery at Santiago, for which preliminary surveys have been made; has carried out geological survey work; has assisted Cuba to run the refineries taken over from the Western companies; and has sent drilling rigs.
14.	CUBA	CZECHOSLOVAKIA			Terms of agreement unknown but Czech technicians are assisting in training Cubans in oil exploration.
15.	CUBA	POLAND			Terms of agreement unknown, but Poland is exporting drilling rigs to Cuba.
16.	CUBA	EAST GERMANY			There may be an agreement, as East German lubricants have been exported to Cuba.

TABLE 18-3 (Cont'd)

CURRENT FREE WORLD AGREEMENTS WITH SOVIET BLOC COUNTRIES INVOLVING OIL/ TECHNICAL ASSISTANCE TO THE OIL INDUSTRY

NO.	FREE WORLD COUNTRIES	BLOC COUNTRIES	NATURE OF AGREEMENT AND PERIOD COVERED	DATE OF SIGNING	DETAILS OF AGREEMENT AND REMARKS
17.	CYPRUS	USSR	Trade and payments agreement. Period unspecified, but trade program laid down for 1962	December 22, 1961	Soviet exports to include oil products.
18.	DENMARK	USSR	Trade agreement for period 1962-63	September, 1961	Includes oil quota of 800,000 tons over the two years.
19.	ETHIOPIA	USSR	Agreement on economic, technical and cultural co-operation. Period unspecified	July, 1959	Protocol to this agreement of March, 1960 opened negotiations on building a refinery and steel works, and a further agreement of November, 1961 made provisions for the construction of a 500,000 tons per annum capacity refinery at Assab, by the USSR. Geological prospecting has also been discussed.
20.	ETHIOPIA	USSR	Trade agreement. Period unspecified	July, 1959	Includes Soviet exports of oil and oil products.
21.	FINLAND	USSR	Trade agreement for period 1961-65 Protocol for trade in 1962	October, 1959 November, 1961	1962 quotas include Soviet oil exports of:- Crude 900,000 - 1,000,000 tons Gas/diesel 700,000 - 800,000 " Fuel oil 800,000 - 900,000 " Kerosine 15,000 and small quantities of other products, to make total approximately 2.4-2.7 million tons.
22.	FRANCE	USSR	Trade agreement 1960-62. Protocol covering trade in 1962	November, 1958 February, 1962	1962 quota for Soviet oil 1.1 million tons, half of which is crude oil. The USSR had hoped for a larger quota, according to some reports.
23.	FRANCE	RUMANIA	Trade agreement covering period 1961-63 and protocols covering trade in each year.		1962 oil quota not yet announced, but it is unlikely to exceed 1961 quota of 290,000 tons.
24.	GREECE	USSR	Trade agreement. Period not known	November, 1961	Crude oil imports ex USSR of 450,000 tons in 1961 and 1962. There were also gasoil imports in 1961, but there was apparently a disagreement as to the term of delivery, and imports may not take place in 1962--no agreement has so far been made covering 1962, after the expiration of the last contract.
25.	GREECE	RUMANIA	Oil and gas prospecting agreement	March, 1960	Rumanian technicians were carrying out an exploration program in Greece in 1960/61. The length of the agreement is not known. Rumania was also to supply equipment.
26.	GREECE	ALBANIA	Private agreement	End of 1959	Under a private agreement between a Greek company and Albania, Albania was to export crude oil and bitumen. This agreement may still be in force.
27.	GHANA	USSR	Economic and technical co-operation agreement. Period unspecified	August,1960	Included provision for Soviet assistance in geological prospecting. A 36 million ruble credit was given.
28.	GHANA	USSR	Trade agreement. Period unspecified. Both of these agreements were reaffirmed in	August, 1960 November, 1961	No details given, but small quantities of Soviet oil were sent to Ghana in 1959.
29.	GHANA	ALBANIA	Trade agreement. Period unspecified	February, 1962	Includes unspecified quantities of Albanian bitumen and asphalt.
30.	GUINEA	USSR	Trade agreement 1961-65. Protocol on trade in 1962	September, 1960 February, 1962	Includes Soviet exports of oil products--manufactures, and other goods, against agricultural products.
31.	GUINEA	USSR	Technical assistance agreement. Period unspecified, but probably for period of Guinea's first 3-Year Plan	Apparently at same time as trade agreements	Credit of 140 million rubles. Projects include assistance in building fuel storage facilities at Conakry airport and, storage facilities in five towns.

TABLE 18-3 (Cont'd)

CURRENT FREE WORLD AGREEMENTS WITH SOVIET BLOC COUNTRIES INVOLVING OIL/TECHNICAL ASSISTANCE TO THE OIL INDUSTRY

NO.	FREE WORLD COUNTRIES	BLOC COUNTRIES	NATURE OF AGREEMENT AND PERIOD COVERED	DATE OF SIGNING	DETAILS OF AGREEMENT AND REMARKS
32.	ICELAND	USSR	Trade and payments agreement. Protocol for deliveries of goods 1960-1962	August, 1953 January, 1960	Quota covers all Icelandic requirements of main products.
33.	INDIA	USSR	Trade agreement under which contract for oil imports was signed,	November, 1958 July, 1960	I.O.C. to import 1-1/2 million tons of petroleum products over four years including kerosine, A.T.F. and gas oil. In November, 1960 the Indians asked the USSR to suspend shipments, and when these were re-commenced in March, 1961 the amount involved in the contract had apparently been increased to 1.9 million tons of oil over three years. Deliveries have not kept up to schedule, and the quantity involved is still vague.
			and a further contract signed	October, 1961	Under this new contract the I.O.C. agreed to take 50,000 tons of fuel oil beginning at the end of 1961.
34.	INDIA	RUMANIA	Trade agreement. Period indefinite	December, 1960	Rumanian deliveries to include petroleum products, drilling equipment, accessories and spares. This is a renewal of a 1954 Trade Agreement. No oil movements have yet taken place.
35.	INDIA	USSR	Various agreements for economic and technical assistance		Current projects include Soviet help in exploration and field development, construction of refineries at Barauni and Baroda, supply of drilling rigs and other equipment, and training of Indian technicians.
36.	INDIA	RUMANIA	Various agreements for economic and technical assistance		Nunmati refinery opened January 1, 1962. Other current projects include assistance in drilling and exploration, and training.
37.	INDONESIA	USSR	Trade agreement for 1961-63	July, 1960	Includes provision for Soviet deliveries of oil products.
38.	INDONESIA	USSR	Technical co-operation agreement	Early 1961	Indonesian oil technicians are being trained in the USSR. First 100 students were due to leave Indonesia early 1962.
39.	INDONESIA	RUMANIA	Technical aid agreement		Rumania offered a credit of $50 million for oil development. Still under negotiation in February, 1962.
40.	IRAQ	BULGARIA	Contract	February, 1962	Iraq to sell to Bulgaria 1,500 tons of asphalt.
41.	IRAQ	USSR	Economic and technical co-operation agreement	March, 1959	Includes provision for Soviet assistance in building chemical plants, and in geological prospecting. Iraq has also purchased Soviet drilling rigs.
42.	IRAQ	CZECHOSLOVAKIA	Economic and technical co-operation agreement	February, 1961	Czechoslovakia to build a refinery at Basrah and two petrochemical plants.
43.	ITALY	USSR	Trade agreement for 1962-65	September, 1961	1962 quotas for Soviet oil exports are:- Crude 4,200,000 tons Fuel oil 700,000 " Wax 3,500 " E.N.I.'s contract apparently comes under the terms of this agreement. There is, of course, no control machinery to keep crude imports within the limits set. Italian exports include equipment and pipes for the oil industry and oil tankers.
44.	ITALY	RUMANIA	Trade agreement for 1962-65	June, 1961	1962 quota for Rumanian exports:- Fuel oil 200,000 tons Gasoline 6,000 " Gasoil 30,000 " also kerosine, liquid gas and lubricants in small quantities.
45.	ITALY	ALBANIA	Trade agreement. Period unstated, but may be for only one year	February, 1962?	Albania to export 100,000 tons of crude, and 15,000 tons of asphalt.
46.	JAPAN	USSR	Trade agreement for 1960-62, and protocol covering trade in 1962	March, 1960 February, 1962	Original 1962 oil quota envisaged was 1,700,000 tons of crude and heavy oils. This has now been revised to 3,400,000 tons (February, 1962). The upper limit set is not mandatory, and has been exceeded in the past. Contracts are made with individual companies--some extending to 1965, which will presumably be covered by later trade agreements. Japanese exports to the Soviet Union include chemicals, tankers, and steel products, which may include pipe.

TABLE 18-3 (Cont'd)

CURRENT FREE WORLD AGREEMENTS WITH SOVIET BLOC COUNTRIES INVOLVING OIL/TECHNICAL ASSISTANCE TO THE OIL INDUSTRY

NO.	FREE WORLD COUNTRIES	BLOC COUNTRIES	NATURE OF AGREEMENT AND PERIOD COVERED	DATE OF SIGNING	DETAILS OF AGREEMENT AND REMARKS
47.	MALI	USSR	Trade agreement for unspecified period	March, 1961	Soviet exports to include oil products.
48.	MALI	USSR	Economic and technical co-operation agreement	March, 1961	Involves a 40 million ruble credit and includes Soviet assistance in prospecting for oil and other minerals.
49.	MOROCCO	USSR	Trade protocol on exchanges of goods in 1962	January, 1962	Soviet exports to include oil, but as they have failed to obtain contract to supply Mohammedia refinery, outlet is limited to Rabat, and any product sales they may make.
50.	NORWAY	USSR	Trade agreement for 1962-64 period	December, 1961	Quota for Soviet oil exports in 1962--250,000 tons.
51.	NORWAY	POLAND	Trade agreement for October, 1961--September, 1964 period	October, 1961	Fuel oil is included in Polish exports.
52.	NORWAY	RUMANIA			There has usually been a trade agreement, including provision for Rumanian oil exports, but there has been some difficulty in arranging the agreement for 1962.
53.	PAKISTAN	USSR	Agreement on co-operation in oil prospecting and surveying during 1961-65 period	March, 1961	USSR has granted a 27 million ruble credit,and will deliver equipment and send specialists for geological prospecting and surveying and to train Pakistani personnel. Rumanian offers are being studied.
54.	PORTUGAL	USSR		January, 1962?	This is a small agreement for the import of 50,000 tons of Soviet gasoil in 1962 against equivalent value of Portuguese goods. There does not seem to be a regular trade agreement between the two countries.
55.	SOMALI REPUBLIC	USSR	Agreement on technical and economic co-operation and trade and cultural co-operation	June, 1961	Soviet oil product exports are not mentioned, but the Somali Prime Minister said that Soviet aid in oil exploration was 'not excluded' under the terms of the agreement.
56.	SPAIN	USSR	Trade agreement for unknown period	Early 1961	Terms and quantities are unknown, but there were imports of Soviet oil in 1961 under this trade agreement.
57.	SUDAN	USSR	Economic and technical assistance agreement	July, 1961	The agreement included provision for training Sudanese workers and technicians and it has been rumored that a refinery offer was made, with the USSR supplying the crude oil.
58.	SWEDEN	USSR	Trade agreement for 1962-64	February, 1962	Soviet exports are to include oil and oil products, and the 1962 quota is reported as from 2.5-2.8 million tons. Swedish exports will include tankers and steel pipe.
59.	SYRIA	USSR	Economic and technical co-operation agreement	October, 1957	This agreement which is apparently still in force, includes provision for Soviet assistance in prospecting for oil and minerals. Soviet drilling rigs are operating in Syria.
60.	TOGO	USSR	Trade agreement for an unspecified period	June, 1961	Soviet exports include oil products.
61.	TUNISIA	USSR	Trade agreement for 1962-64	March, 1962	Soviet exports to include oil products.
62.	UNITED ARAB REPUBLIC	USSR	Trade and payments agreement	1954	This agreement, with presumably annual protocols, still apparently governs Russo-Egyptian trade. In 1962, the USSR will supply 1,300,000 tons of crude, and buy back 65,000 tons of gasoline. There may also be product exports, as in the past.
63.	UNITED ARAB REPUBLIC	USSR	Technical and economic co-operation agreement	January, 1958	Present aid under this agreement appears to include oil exploration and development in the Egyptian Governments arles.
64.	WEST GERMANY	USSR	Trade agreement for 1961-63 period	December, 1960	1962 oil quota:- Crude 1,800,000 tons Diesel 275,000 " Fuel oil 425,000 " Gasoline 110,000 " Basic lubes. 10,000 " 2,620,000 "

TABLE 18-3 (Cont'd)

CURRENT FREE WORLD AGREEMENTS WITH SOVIET BLOC COUNTRIES INVOLVING OIL/TECHNICAL ASSISTANCE TO THE OIL INDUSTRY

NO.	FREE WORLD COUNTRIES	BLOC COUNTRIES	NATURE OF AGREEMENT AND PERIOD COVERED	DATE OF SIGNING	DETAILS OF AGREEMENT AND REMARKS
65.	WEST GERMANY	HUNGARY	Trade protocol for 1962	Early 1962?	DM 10,000,000 oil products included.
66.	WEST GERMANY	POLAND	Trade protocol for 1962	Early 1962?	DM 17,000,000 oil products included.
67.	WEST GERMANY	RUMANIA			Annual quotas, but 1962 details not available.
68.	WEST GERMANY	CZECHOSLOVAKIA			Annual quotas, but 1962 details not available.
69.	YEMEN	USSR	Trade agreement	March, 1956	This agreement is still valid, and includes provision for exports of Soviet oil products.
70.	YUGOSLAVIA	USSR	Trade agreement for 1961-65. Protocol for 1962	March, 1961 February, 1962	Soviet deliveries will include oil and oil products and Yugoslav deliveries will include 16 tankers during the five year period, although the 1962 protocol does not mention any tanker deliveries this year.

N.B.

1. The above list cannot be taken as definitive. Agreements, especially those with some of the East European countries do not always receive publicity.

2. Imports of Soviet oil are also made in some countries e.g., Benelux, Switzerland, United Kingdom where there are no known trade agreements involving oil.

3. Import quotas are only given for 1962, although in some cases provisional quotas have been given for future years.

4. No attempt has been made to give prices, individual importing customers, or other details.

TABLE 18-4

SOVIET BLOC CRUDE SALES TO FREE WORLD - BY COUNTRY AND BY TYPE OF PURCHASER*
1961
(Thousand Metric Tons)

	GOVERNMENT OIL COMPANIES	INTEGRATED	NON-INTEGRATED	UNKNOWN	TOTAL
WESTERN HEMISPHERE					
Brazil	280	0	35	0	315
Cuba	3,075	0	0	0	3,075
Uruguay	50	0	0	0	50
TOTAL	3,405	0	35	0	3,440
EUROPE					
Austria	165	0	0	0	165
Belgium	0	0	0	0	0
Denmark	0	0	0	0	0
Finland	875	0	0	0	875
France	0	0	110	0	110
West Germany	1,000	385	235	0	1,620
Greece	500	0	0	0	500
Iceland	0	0	0	0	0
Italy	2,350	0	3,000	215	5,565
Netherlands	0	0	0	0	0
Norway	0	0	0	0	0
Spain	0	0	0	0	0
Sweden	0	0	0	0	0
Switzerland	0	0	0	0	0
United Kingdom	0	0	0	0	0
Yugoslavia	100	0	0	0	100
TOTAL	4,990	385	3,345	215	8,935
OTHER EASTERN HEMISPHERE					
Ceylon	0	0	0	0	0
Egypt	1,500	0	0	0	1,500
India	0	0	0	0	0
Japan	0	0	2,065	0	2,065
Other Countries	0	0	0	50 a/	50
TOTAL	1,500	0	2,065	50	3,615
TOTAL FREE WORLD	9,895	385	5,445	265	15,990
PERCENT OF KNOWN	63	2	35	-	-

* Committee estimate.
a/ Probably mostly government.

TABLE 18-5

SOVIET BLOC PRODUCT SALES TO FREE WORLD - BY COUNTRY AND BY TYPE OF PURCHASER*
1961
(Thousand Metric Tons)

	GOVERNMENT OIL COMPANIES	INTEGRATED	NON-INTEGRATED	LARGE CONSUMERS	UNKNOWN	TOTAL
WESTERN HEMISPHERE						
Brazil	195	0	0	0	0	195
Cuba	825	0	0	0	0	825
TOTAL	1,020	0	0	0	0	1,020
EUROPE						
Austria	60	130	230	85	0	505
Belgium	0	0	100	0	240	340
Denmark	0	0	0	215	5	220
Finland	170	845	190	45	260	1,510
France	0	0	1040	0	0	1,040
West Germany	0	430	1,920	0	155	2,505
Greece	100	0	0	0	300	400
Iceland	0	175	125	0	0	300
Italy	265	0	440	0	60	765
Netherlands	0	0	0	0	50	50
Norway	0	225	0	25	0	250
Spain	100	0	0	0	0	100
Sweden	0	0	2,565	0	0	2,565
Switzerland	0	0	85	0	15	100
United Kingdom	0	0	0	115	0	115
TOTAL	695	1,805	6,695	485	1,085	10,765
OTHER EASTERN HEMISPHERE						
Ceylon	50	0	0	0	0	50
Egypt	850	0	0	0	0	850
India	95	0	0	0	155	250
Japan	0	0	675	0	0	675
Other Countries	0	0	0	0	900 a/	900
TOTAL	995	0	675	0	1,055	2,725
TOTAL FREE WORLD	2,710	1,805	7,370	485	2,140	14,510
PERCENT OF KNOWN	22	15	59	4	-	-

* Committee estimate.
a/ Probably mostly government.

C. Significance of Soviet Bloc Oil Trade in Selected Countries

Trade with the Soviet Bloc has had a highly significant effect on the politics and economies of a number of countries in the Free World. In many cases imports of Communist oil can be seen to play a major role. Some examples illustrating the importance of trade with the East in general and imports of Soviet Bloc oil in particular are given below:

1. Finland

Finland is particularly vulnerable to pressures from the Soviet Bloc. Her long, common border with the USSR is a continual reminder that she is geographically tied to the most powerful member of the Bloc. The Finnish Communist Party has an important voice which is amplified by support from the Soviet Union's propaganda machine and political maneuvers. She has been forced to become economically dependent on the Soviet Union and other members of the Bloc to a considerable degree. This is shown in the following table:

FINLAND'S MAJOR EXPORTS IN 1960*
($U.S. MILLIONS)

ITEM	TO SOVIET BLOC	TO ALL OTHER COUNTRIES	TOTAL	PERCENT TO SOVIET BLOC
Ships and Boats	64.5	17.0	81.5	79.1
Paper and Manufactures	37.0	211.3	248.3	14.9
Pulp and Waste Paper	25.0	144.6	169.6	14.7
Miscellaneous Machinery	14.6	12.1	26.7	54.7
Timber, Rough and Hewn	10.9	252.0	262.9	4.1
Electrical Machinery and Equipment	6.5	2.9	9.4	69.1
Miscellaneous Metal Manufactures	6.1	2.9	9.0	67.8
TOTAL ABOVE ITEMS	164.6	642.8	807.4	20.4
FINLAND'S TOTAL EXPORTS	193.1	796.0	989.1	19.5

* U.N. Commodity Trade Statistics, January-December, 1960

It can be seen that the Bloc got mainly ships, paper, pulp and machinery. Well over half of Finland's exports of ships, machinery and manufactured metals went to Bloc purchasers. The Communist countries currently have on order 18 tankers of the 5,000 dwt. class for delivery by 1965. These tankers will presumably be used for export trade in the Baltic Sea area.

While Finland's export earnings have increased substantially since 1958, her imports rose even more rapidly and she incurred an appreciable foreign trade deficit in 1960 and 1961, with both Free World and Soviet Bloc trade contributing to the deficit. She thus finds herself in the current position of needing increased export outlets. Although the percentage of Finland's trade with the Bloc has been declining, there is evidence that the Soviet Union is anxious to recoup some of its share. Finland's trade agreement with the USSR for 1962 called for higher imports and exports and a planned trade surplus to be settled by the USSR in gold and convertible currencies.

Oil imports have played an important and increasing role in Finland's trade with the Bloc. Oil currently accounts for 24 percent of all of Finland's imports from the Bloc countries compared to 12 percent in 1956.

To accommodate the Communist oil, she has found it necessary to almost completely back out her supplies from Free World sources, which provided all of Finland's requirements in the early 1950's.

FINLAND'S OIL IMPORTS FROM THE
SOVIET BLOC COMPARED WITH LOCAL DEMAND

	THOUSAND METRIC TONS PER YEAR a/	PERCENT OF LOCAL DEMAND b/
1955	912	73
1956	1,272	76
1957	1,369	81
1958	1,269	73
1959	1,896	98
1960	2,238	91
1961	2,385	78

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a/ From Tables 18-2a, 18-2b, and 18-2c.
b/ Committee Estimate.

This accommodation has been achieved through government purchases of Soviet crude and products and government insistance that free enterprise oil companies handle Bloc products in their facilities. In 1961 for example, 100 percent of all Soviet Bloc crude and 11 percent of all Bloc products were purchased by the government oil company. Thirty-three percent of the Communist products were purchased by small oil companies or directly by consumers. Fifty-six percent of Soviet Bloc products or 845 thousand metric tons were disposed of by Free World integrated oil companies at the expense of outlets for oil from their own sources.

Although the Soviet Union has not charged Finland the exorbitant prices for oil that are reserved for the completely captive satellite countries, Finland has not had the advantage of the cut-rate Communist oil which is the privilege of the Western countries trading in a free market. Figures 12 and 15 in another section of this report show that in general Finland has paid prices intermediate between those paid by the satellites and the free traders. In 1960 for example, the average Soviet FOB export price for crude to Finland was $1.72 per barrel compared with an average price of $1.56 per barrel to the Free World and $3.01 per barrel to the captive satellite nations. West Germany, in a comparable geographic area paid $1.38 per barrel (FOB Soviet border) while East Germany paid $2.69 per barrel. For heavy fuel oil the Soviet FOB export price to Finland was $1.87 per barrel in 1960 compared with $1.48 to Sweden and $2.73 to Poland.

In summary, Finland's position of being highly subject to political pressures from the USSR has led to a high degree of dependence on trade with the Bloc. This dependence, in turn has given additional leverage to Soviet influence on Finland's political and economic life. As pointed out on Page 430, the USSR has not hesitated to use trade as a weapon in the internal politics of Finland. In addition, Finland's trade with the Soviet Bloc has seriously limited the free enterprise oil industry in the country and made her almost completely dependent on the Bloc for petroleum energy.

2. <u>West Germany</u>

West Germany is by far the largest Free World trader with the Soviet Bloc. Since 1952, when West Germany first gained significance in international commerce, her exports to the Communist countries have grown over eight-fold, to

$765,000,000 in 1960. Imports from the Bloc in 1960 totalled $719,000,000. Seven percent of West Germany's total trade in that year was with the Bloc and indications are that commerce with the East is continuing its rapid climb.

Imports of Soviet Bloc oil in 1960 represented a highly significant value of $89.2 million, or 12.4 percent of her total imports from the Communist countries. In terms of volume, West Germany is the second largest consumer of Soviet Bloc petroleum in the Free World. The growth in imports of Bloc oil by West Germany is shown in the following table:

WEST GERMANY'S OIL IMPORTS FROM THE SOVIET BLOC COMPARED WITH LOCAL DEMAND

	THOUSAND METRIC TONS PER YEAR a/	PERCENT OF LOCAL DEMAND b/
1955	260	2
1956	553	3
1957	1,522	8
1958	1,387	6
1959	2,176	8
1960	3,197	9
1961	4,125	10

a/ From Tables 18-2a, 18-2b, and 18-2c.
b/ Committee Estimate.

Not only has the absolute rate of rise been large but the proportion of West Germany's total petroleum demand, supplied by the Bloc, has increased to 10 percent, a significant amount for such a highly industrialized country. In addition to the Soviet Bloc oil which is shown in the table, there is an unknown volume of products made from Soviet crude and imported from third countries.

The mechanism for the absorption of the oil has been through purchases by the government oil company as well as by private companies. The major purchases by private companies have been made by those which do not have their own source of crude, although government suggestion has resulted in a certain amount of off-take by integrated companies as well, as illustrated in the following table:

SOVIET BLOC OIL PURCHASES BY
WEST GERMAN BUYERS* - 1961
(Thousand Metric Tons)

PURCHASED BY	SOVIET CRUDE	SOVIET BLOC PRODUCTS	TOTAL	PERCENT OF KNOWN SOVIET BLOC OIL
Government Oil Co.	1,000	0	1,000	25
Integrated Oil Cos.	385	430	815	21
Non-Integrated Oil Cos.	235	1,920	2,155	54
Large Consumers	0	0	0	0
Unknown	0	155	155	-
TOTAL	1,620	2,505	4,125	100

*From Tables 18-4 and 18-5.

The chief motivation for the oil companies to purchase Soviet Bloc petroleum in West Germany is price. Crude from the USSR and products from Rumania, East Germany, Czechoslovakia and Hungary are consistently offered at prices below the German border prices for Free World oil. In 1961 for example, German c.i.f. prices for Turmazy crude were about $1.70 per barrel equivalent to $1.11 per barrel netted back to the Persian Gulf. The average USSR f.o.b. export price for crude to West Germany in 1960 was officially put at $1.38 per barrel.

Through its export trade to the Soviet Bloc, West Germany is an important supplier of materials which are critical in the economic expansion of Communist countries. Exports to the Bloc in 1960 were as follows:

WEST GERMAN EXPORTS TO THE SOVIET BLOC* - 1960

ITEM	$U.S. MILLION
Metals and Metal Shapes	317.4
Machinery and Plants	206.3
Chemicals	91.4
Other Manufactured Goods	73.8
Transport Equipment	16.0
All Other	60.5
TOTAL	765.4

* From Table 17-3.

In that year 92 percent of her exports to the Communists consisted of metals and metal shapes, machinery and plants, chemicals, transport equipment and other manufactured goods. These are the areas where the Bloc has the greatest difficulty in supplying its own needs at reasonable cost and effort. An item of particular interest to the oil industry is the 500,000 tons of 40 inch steel pipe which were exported to the USSR between 1959 and 1961 and the additional 180,000 tons contracted for in 1962. This pipe is responsible for essentially all the 40 inch line installed in the Soviet Union. It has been used for gas transport, thus contributing directly to the availability of more liquid petroleum for export.

It should be noted that an appreciable proportion of West Germany's trade with the Bloc is with East Germany. In 1960, 38 percent of West Germany's imports from the Bloc originated in East Germany, and 30 percent of West Germany's exports to the Bloc were shipped to the Eastern zone.* There are powerful political and psychological pressures to continue this trade, in addition to the purely economic advantages. Apparently West Germans see trade as weakening the political barriers between the two Germanies. The free enterprise petroleum industry is paying an appreciable portion of the price for continuing this trade. Petroleum products represented $44 million, or 16 percent of the value of imports from East Germany, in 1960.*

3. Sweden

Sweden is traditionally neutral in times of war and apparently is anxious to maintain neutrality in the current economic struggle between East and West. Her 1960 imports from the Communist countries amounted to $127,000,000 in value and exports to them were $124,000,000. Such trade represented less than 5 percent of the total Swedish world trade. Sweden is one of the few major traders with the Bloc whose proportion of exports to the East has shown a decline over the last decade.

On the other hand, the desire of the Soviet Union to sell oil has found ready acceptance in the Swedish market. Petroleum has recently been by far the most important item in Swedish imports from the Communist countries, representing 32

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* U.S. Department of Commerce Country by Country Commodities Series, 1960.

percent of the total value in 1961. The result has been a growing dependence on the Bloc since 1957 for Sweden's petroleum energy supplies and she is now the fifth largest Free World buyer (by volume) of Communist oil.

SWEDEN'S OIL IMPORTS FROM THE SOVIET BLOC COMPARED WITH LOCAL DEMAND

	THOUSAND METRIC TONS/YEAR a/	PERCENT OF LOCAL DEMAND b/
1955	971	11
1956	774	8
1957	556	6
1958	925	9
1959	1,516	14
1960	2,093	16
1961	2,565	19

a/ From Tables 18-2a, 18-2b, and 18-2c.
b/ Committee Estimate.

Imports of Communist oil, which consist wholly of products, are arranged by a small number of independent oil companies or brokers. The disposition of heavy fuel oils and distillates is greatly facilitated by the fact that many large consumers own substantial harbor tankage which has been government subsidized as part of Sweden's compulsory storage program. Deliveries of 5,000 tons or larger may be directly from Bloc sources into consumers' tanks. Thus about 80 percent of all Communist oil into Sweden is heavy fuel oil with the bulk of the remainder as distillates. The result has been a heavy inroad of Communist oil into the energy supplies of industries. In 1961 almost 40 percent of Sweden's heavy fuel oil requirement was supplied by the Bloc. This heavy dependence is reported to be of some concern to the country's authorities.

Sweden has a favored position in the Communist oil market with respect to price. According to official Soviet statistics, heavy fuel oil, which is the major portion of the purchases, was exported to Sweden at an average FOB price of $1.48 per barrel. Currently Swedish imports of Soviet fuel oil are made at about $1.75-$1.80 per barrel c.i.f. Swedish border. This nets back to the Caribbean at about $1.35 per barrel and may be compared with current Caribbean postings of $2.00 per barrel.

There are strong indications that the trade agreements between Sweden and the Bloc are frequently written in such a way that the industrial interests, who may be considered as customers or brokers for Bloc oil, are also in the position to provide many of the products which Sweden is to export. Thus there is a flavor of the direct barter of goods between the interests and the Bloc. As in the case of the other highly developed countries, the majority of the goods which Sweden supplies to the Bloc are in the category of metals and manufactured goods which are a valuable contribution to the growth of the Bloc economy. Of particular interest to the oil industry are the 135,000 tons of 40 inch pipe which are scheduled for delivery to the USSR in 1962-64.

One factor which may have a significant effect on Swedish trade is the credit of 1 billion Swedish Kroner ($ U.S. 19.3 million at current rate of conversion) which was extended to the USSR in 1946. Amortization of this credit is to be made between 1961 and 1967 and there will probably be pressure by the USSR to make repayments to Sweden in Soviet goods including oil. The 1962-64 trade agreement with the USSR increased Swedish import quotas for Soviet goods by about 20 percent over the actual imports for the previous 3-year period.

4. Iceland

Iceland is the most dependent of the NATO countries on trade with the Soviet Bloc. The ability of Iceland to engage in international commerce has been essentially a function of her ability to export fish and fish preparations. It was thus a critical blow to her economy when in 1952 Icelandic fish were excluded by boycott from the United Kingdom market as the result of a dispute over territorial waters. This move came on the heels of reductions in Iceland's markets in the United States and Europe for various economic reasons. Iceland then turned to the countries of the East Bloc for her outlets. The Soviet Union offered oil in return for fish and since that time the USSR has furnished almost all of Iceland's petroleum needs.

ICELAND'S OIL IMPORTS FROM THE
SOVIET BLOC COMPARED WITH LOCAL DEMAND

	THOUSAND METRIC TONS PER YEAR a/	PERCENT OF LOCAL DEMAND b/
1955	283	77
1956	259	65
1957	300	79
1958	332	86
1959	365	89
1960	339	81
1961	300	88

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a/ From Tables 18-2a, 18-2b, and 18-2c.
b/ Committee Estimate.

The 300 thousand tons of imports in 1961 represented 47 percent of the value of Iceland's total imports from the Bloc.

Soviet Bloc petroleum products are imported by private oil companies and handled in their facilities at government insistence. This is another example where the supplies of free enterprise oil companies have been backed out and replaced by Soviet oil in facilities provided by private capital. For the Soviet oil Iceland pays among the highest prices of all Free World purchasers.

For a number of years Iceland has had a relatively large unfavorable balance of trade. Partly because of devaluation of Iceland's currency in both 1960 and 1961 and partly because of higher demand in the West, Iceland's trade with the West has increased sharply in the last two years. In 1961 she actually had a favorable balance with the Free World amounting to $3.8 million, which, however, was more than cancelled by an unfavorable balance of $7.0 million with the Bloc. Exports to the Bloc in that year fell to 14 percent of her total world exports compared with about 24 percent the previous year. The breakdown for 1961 is shown in the following table:

ICELAND'S IMPORTS AND EXPORTS
OF MAJOR COMMODITIES, 1961 a/
($U.S. Millions)

EXPORTS	TOTAL	WITH SOVIET BLOC
Fish and preparations	51.0	8.7
Feeding stuff for animals	9.2	-
Animal oils and fats	4.9	.3
Hides and skins	2.6	-
Meat and preparations	1.6	-
Sub-Total	69.3	9.0
All Other	2.2	1.1
TOTAL	71.5	10.1
IMPORTS		
TOTAL	74.7	17.1

a/ OEEC Foreign Trade Analytical Abstracts, Series B, January-December, 1961.

If Iceland can sustain her gain with the West there should be a lessening dependence on trade with the Communists.

5. Italy

Italy has been the largest Free World purchaser (by volume) of Communist Bloc oil since 1958, and since 1959 she has been the best customer for USSR export oil of any nation in the world, including China and the satellite countries. Italy's imports of Soviet Bloc oil in recent years have been as follows:

ITALY'S OIL IMPORTS FROM THE SOVIET BLOC
COMPARED WITH LOCAL DEMAND

	THOUSAND METRIC TONS PER YEAR a/	PERCENT OF LOCAL DEMAND b/
1955	253	2
1956	530	4
1957	647	4
1958	1,182	7
1959	3,146	16
1960	4,822	20
1961	6,330	22

a/ From Tables 18-2a, 18-2b, and 18-2c.
b/ Committee estimate.

As shown in the table, in 1961 the imports of Communist oil were equal to 22 percent of the Italian internal demand for petroleum. Italy, however has a significant export market. If total Bloc imports are compared to domestic plus export demand, the proportion that Bloc oil comprised is reduced to 17 percent for 1961.

Italy's exports to the Soviet Bloc in 1960 totalled \$212,000,000, or 5.8 percent of her total world exports, and imports from the Bloc were \$289,000,000, or 6.1 percent of her total world imports. The importance of oil in this Bloc trade is illustrated by the fact that the value of the Communist oil imported in that year was 21 percent of Italy's total imports from the Bloc, and was equivalent in value to over 29 percent of her total exports to the Bloc. Thus the oil received from the Bloc paid for almost one-third of Italy's exports to the Communist nations.

The government oil company, ENI, has played an important role in Soviet Bloc oil imports into Italy. At present ENI probably purchases about one-half of the Communist oil brought into the country. ENI has publicly championed Italy's right to get her oil supply from the cheapest source available. In addition, the company's spokesmen have been vigorous in pointing out what they refer to as the advantages of inter-government dealings for oil supplies outside the framework of the established free enterprise oil industry. The prices ENI pays for Soviet crude are unusually favorable. Reportedly it is paying

$1.08 per barrel, f.o.b. Black Sea, for 60,000 barrels per day of crude. This is equivalent to only 85¢ per barrel when netted back to the Persian Gulf, and is a price which could obviously not be met by any competitive free enterprise supplier. Other Italian purchasers are paying the equivalent of about $1.05 to $1.15 per barrel for Soviet crude netted back to the Persian Gulf--also very attractive prices, though not in the favored position held by ENI.

Not only is the government company buying Soviet crude at an extremely low price, but in addition, manufacturing concerns which are affiliated with ENI are making important sales of manufactured goods and technology to the Bloc. In October 1960, for example, ENI concluded an agreement governing trade exchanges between ENI and the USSR for the 1962-1965 period. In this contract ENI agreed to purchase a total of 12 million tons of crude oil for the period, and the Soviet Union agreed to purchase 50,000 tons of synthetic rubber, 240,000 tons of 40-inch pipe, pumps, and other pipeline equipment from companies affiliated with ENI.

Italy imports a substantially higher proportion of Soviet Bloc oil than any other nation in the Common Market. Her position on Bloc oil imports has important implications for the entire European Economic Community. Some of the other nations of the Common Market have shown a desire to limit their dependence on Soviet Bloc oil and have indicated a concern with the uncontrolled flow into the rest of the Common Market of products from Soviet Bloc crude refined in Italy. Up to this time agreement among the countries on means and levels for control of Communist oil has not been reached.

There are indications, however, that Italy has plans to limit its Communist oil imports to some degree. Reportedly there is an agreement with the USSR that Soviet crude should not exceed 14 percent of Italy's total crude imports. By comparison, however, Soviet crude represented 17 percent of Italy's total crude imports in 1961. There is no comparable announced limitation on petroleum products to be imported from the Bloc or on crude to be imported from any satellite countries.

6. Brazil

Brazil depends largely on agricultural products for earning foreign exchange, with which she buys manufactured goods and vehicles, fuel, chemicals and wheat. Coffee is by far the most important export but the price has fallen steadily since

1954. The obligation to withhold surpluses from the export market has resulted in the accumulation of huge stock piles, and the loss of earnings precipitated serious foreign exchange crises. Attempts to alleviate these crises and curtail foreign exchange expenditure have included the establishment of a local vehicle manufacturing industry; extensive development of indigenous energy, oil, coal, and hydro-electricity; a drive to achieve self-sufficiency in wheat production; and bilateral trade with the Soviet Bloc. These attempts have met with varying degrees of success, however, two-thirds of the country's oil requirements still have to be imported (a proportion which may well increase) and about one-fifth of the imports bill goes on fuels.

The first trade agreement signed with the USSR, in 1958, entailed an exchange of cocoa for crude oil and gasoil/diesel fuel, but was not particularly successful. A second three-year agreement, concluded early in 1960, has also run into difficulty, mainly on grounds of crude oil quality. In April 1961, the leader of a Brazilian trade mission to Eastern Europe stated that the mission's objective was "to divert all possible imports from the dollar area, not because of any predisposition against the dollar, but simply because we have no dollars". This mission reached agreement to exchange coffee for coastal vessels, fertilizers, wheat, machinery, chemicals, crude oil and products. A possible danger is that the East Europeans may try to acquire hard currency by reselling coffee in one of Brazil's best markets, West Germany.

Soviet oil sales to Brazil are simplified by the fact that the State Agency, Petrobras, is the main customer for crude oil. Recently a move was made to place all crude imports under Petrobras control.

Oil consumption is expected to continue to be far in excess of local production, and this has led the Government to try and develop a shale oil industry, in which connection they are receiving Soviet technical aid.

Details of Soviet Bloc oil supplies to Brazil are given in the following table:

BRAZIL'S OIL IMPORTS
FROM THE SOVIET BLOC a/

	THOUSAND METRIC TONS PER YEAR
1959	59
1960	161
1961	510

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a/ Derived from Tables 18-2b, 18-2c.

7. Far East

The activities of the Soviet Bloc in the oil economy of the Far East have taken several forms:

a. Sales and offers of sales which seem largely politically motivated

b. Sales which seem largely economically motivated

c. Capital assistance

d. Technical assistance

Examples of these forms are discussed below.

a. Sales and offers of sales which seem largely politically motivated

In 1960, representatives of the Soviet Oil Export Agency visited Australia. A certain publicity was given to the fact that cut-rate oil would be available to Australian buyers; advertisements to this effect were taken in financial newspapers; and the Soviet delegates lost no opportunities to issue, through press conferences, the usual charges of "monopoly prices" which the Australian public were paying through the domination of their oil industry by the international majors. The Soviets departed without any buyers--and it may be doubted whether they really expected to find any--but they did succeed in creating a small storm of adverse criticism of the international oil industry by its critics in Australia.

On the other hand, the offer in the Spring of 1960 by the USSR to the Indian government of 50,000 barrels per day of oil for rupees appears to have been well calculated to strike at the foundations of the oil industry structure in India. The timing was shrewd. The discount pricing of the offer was equally well calculated. The result was an immediate and sharp exacerbation of the already strained relations between the Indian government and the major oil companies who had been negotiating on a number of issues, not the least of which was the problem of oil prices in the context of the Indian balance of payments problem. The subsequent agreement of the individual oil companies to some form of discount, under the pressure of the Soviet offer, contributed to the factors which precipitated the reduction of Middle East posted prices of August, 1960, but the factors of timing in the Soviet offer were such that oil company-Indian relations were left in a state of unresolved tension. It is ironic that this offer was never consummated.

Refined product sales have been made by the USSR in small quantities to India and also to Ceylon. It is expected that sales will increase fairly sharply with the signing in December, 1961, of a new trade agreement with Ceylon and the partial expropriation there of the privately owned installations by the new, state-owned Ceylon Petroleum Corporation. Similarly, in India, the expansion of the state-owned India Oil Company is expected to lead to a fairly sharp increase of Bloc product imports. As in the case of the crude oil offered to India, however, it appears certain that the political objectives (and gains) of the Soviets far outweigh the commercial value to the Soviet economy of these relatively small volumes of barter trade.

b. Sales which seem largely economically motivated

By contrast the Soviet sales effort in respect to crude oil in Japan appears to have been much more of a commercial proposition. With an oil industry structure characterized by a substantial number of independents, there existed ready outlets for discounted Soviet oil, Soviet Bloc oil sales rose to 2.7 million metric tons in 1961, representing 7 percent of Japan's internal demand.

Recently the USSR has made attempts to draw the Japanese economy into a somewhat closer relationship with the Bloc. Their inducement has been the lure of very substantial export contracts for large diameter steel pipe in exchange for larger quantities of crude oil. The pipe would presumably be used to complete the trans-Siberian pipeline to the eastern port of Nakhodka, just north of Vladivostok. The timing of the Soviet offer was excellent; it was most vigorously pushed when the foreign exchange accounts of Japan had swung badly out of balance. The Japanese, however, have not yet made any commitments.

c. Capital Assistance

The Bloc has been a substantial contributor to the Second India Five Year Plan--and to the realization of New Delhi's wishes to enter the oil business actively itself. One Rumanian refinery and one refinery of Soviet design have been provided as capital grants to the India Oil Company. The first has been completed and is on test, the second is scheduled for completion later in 1962/63. Both of these refineries have been constructed at costs substantially higher than private industry would require. They will both process local crude oil and cannot, therefore, be counted as specific Soviet levers to displace Western oil. They nonetheless contribute to the problems of State vs. private enterprise in India which is, most certainly, a Soviet objective.

In 1961, the Soviets signed an agreement whereby some \$35 million in 12 year 2-1/2 percent loans would be provided to the Pakistan government to finance the costs of oil exploration within the country. The terms provide that the loan will be repaid in Pakistan exports whether or not oil is found; the country has, thereby, placed a sizeable mortgage on future sterling and dollar export earnings. To implement the agreement the Pakistan government has had to establish a full-fledged Government-owned exploration company. Thus, the longer range thrust of the Soviet offer has been, as in the case of India and Ceylon, to bring into being a new socialist instrument for the sharpening of difficulties between the public and private sectors and between the foreign investor and the Asian governments.

d. Technical Assistance

The USSR for sometime has been providing technical assistance to India for exploration and field development and in addition is training substantial numbers of Indian technicians. Recently, the Soviets entered into an agreement with the Indonesian government whereby one hundred Indonesian students, technicians and administrators will be sent to the USSR for training. The oil industry in Sumatra now must contemplate the prospect of negotiating with a whole generation of Soviet trained Indonesians. This would appear to have been an important Soviet objective.

D. Forecasts of Future Bloc Petroleum Exports

In an earlier section of this report, supply/demand projections for the individual countries of the Sino-Soviet Bloc lead to predictions that in 1965 the USSR will have available 27 million tons of crude and 19 million tons of products for export to the Free World, and that the East European Satellites would have an additional 5 million tons for Free World markets. Whether the 51 million tons total will actually be sold in the Free World can only be determined by the political and economic climates at the time. There is no doubt, however, that if the predictions of the exportable availability of Soviet Bloc oil are borne out, the pressures to move it into the Free World will be intense.

A study was made to determine where this oil might go, if corrective action is not taken and it is permitted to continue through its channels into the West. Table 18-6 gives a possible distribution of the 51 million tons of Communist oil under this assumption. The table was derived from a country-by-country analysis of predicted total demand patterns, historical imports of Soviet Bloc petroleum, types of purchasers, refining and marketing facilities which could be considered potentially available to handle Communist crude and imports, existing long-term trade agreements and possible political attitudes.

The most significant point is, however, that whether this much Communist oil actually enters the Free World in 1965, and where it will go if it does, is a function of the actions taken throughout the West between now and then.

TABLE 18-6

POSSIBLE SOVIET BLOC EXPORTS
OF PETROLEUM TO THE FREE WORLD
BY GENERAL GEOGRAPHIC AREA
IN 1965 COMPARED WITH 1961
(Million Metric Tons)

GEOGRAPHIC AREA	1961			1965		
	CRUDE	PRODUCTS	TOTAL	CRUDE	PRODUCTS	TOTAL
Northern Europe	2	7	9	4	12	16
Western and Central Europe	1	2	3	1	4	5
Southern Europe and North Africa	8	2	10	8	5	13
Other Africa and Far East	2	2	4	8	2	10
Western Hemisphere	3	1	4	6	1	7
TOTAL	16	14	30	27	24	51

SECTION 49

EFFECT ON PETROLEUM EXPORTING COUNTRIES

A. Countries Affected

During the 1950's, 1960 and 1961, the principal suppliers of petroleum in world trade were Venezuela and the Middle East. The United States, though still the world's biggest producer of oil, had become a net importer, and its exports had dwindled to nominal volumes. Indonesia and North Africa were making significant exports to Free World markets, but the exports from these areas satisfied only a relatively small proportion of offshore demand. The balance of this demand was met largely by supplies from the Middle East.

During the period under discussion, it is thus safe to regard Venezuela and the Middle East as the major sources of marginal supplies of oil for Free World markets, the allocation between those two areas being determined mainly by geographical factors. Insofar as Soviet Bloc oil exports reduced the volume of exports from Free World producing countries, Venezuela and the Middle East were the principal sufferers. In the following analysis of the effect upon Free World producing countries of the increasing volume of Soviet Bloc oil exports, attention will, therefore, be confined to these two areas.

B. Oil Income

1. Direct Payments

Direct payments to the major Free World oil exporting countries consist mainly of royalties and income tax payments, often stipulated in basic contractual agreements. Payments made by oil companies to the governments of Venezuela and the Middle Eastern countries are shown in Table 18-7.

2. Other Expenditures

In addition to payments of tax and royalties, and other payments precisely stipulated in basic contracts, oil companies incur other expenditures in oil producing countries which, though usually smaller than direct payments after commercial production has commenced, are nevertheless important to oil producing countries' national economies. Such "other expenditures"

TABLE 18-7

INCOME FROM OIL INDUSTRY IN VENEZUELA a/ AND THE MIDDLE EAST b/
1953-1961

	1953	1954	1955	1956	1957	1958	1959	1960	1961
VENEZUELA									
Million Bolivares	1,589	1,498	1,714	3,037 c/	3,822 d/	2,711	3,224	3,001	3,185 e/
$ U.S. Million	514	485	555	983 c/	1,237 d/	877	1,043	971	1,031
Exchange Rate, Bolivares per $ U.S.	3.09	3.09	3.09	3.09	3.09	3.09	3.09	3.09	3.09
BAHRAIN									
$ U.S. Million	5	11	9	10	10	12	13	13	13
IRAN									
$ U.S. Million	-	9	91	153	213	272 f/	262	285	291 e/
IRAQ									
$ U.S. Million	144	191	206	193	144 g/	237 h/	242	266	266
KUWAIT AND 50% NEUTRAL ZONE									
$ U.S. Million	169	194	282	293	308	354	345	440	440 i/
QATAR									
$ U.S. Million	18	30	35	36	45	61 j/	53	54	54 i/
SAUDI ARABIA AND 50% NEUTRAL ZONE									
$ U.S. Million	226	281	275	283	303	302	315	332	365 e/
TOTAL MIDDLE EAST									
$ U.S. Million	562	716	898	968	1,023	1,238	1,230	1,390	1,414 e/

a/ 1/
b/ 2/
c/ Includes bonuses for concessions of 974 million barrels ($315 million).
d/ Includes bonuses for concessions of 1,142 million barrels ($370 million).
e/ Partly estimated.
f/ Includes bonuses for concessions of $25 million.
g/ Includes $ U.S. 7 million in settlement of previous claims.
h/ Includes $ U.S. 12.6 million in settlement of previous claims.
i/ Estimated.
j/ Includes $ U.S. 3.3 million in settlement of previous claims.

include wages and salaries paid to employees of local nationality, personal income taxes paid by expatriate employees, payments to local contractors, and payments for local purchases of goods. The exact level of these "other expenditures" is difficult, if not impossible, to define in a manner which would permit satisfactory comparison, from country to country. It is certain, however, that they not only provide directly the means of support for many tens of thousands of company employees and their dependents, but also make a substantial contribution--and sometimes the principal contribution--to the prosperity and livelihoods of merchants and small businessmen running into the thousands. Some idea of their scale may be gained from a few examples:

(a) In 1960, Kuwait Oil Company ordered 56% of all its purchases, amounting to about £3,075,000 worth ($8.6 million), through more than 200 merchants in the Kuwaiti business community. In addition, it made payments of over £3,900,000 ($11 million) to Kuwaiti companies for direct contracts, service contracts and rentals. 3/

(b) In 1960, Iraq Petroleum Company and its associated companies operating in Iraq spent nearly £20,000,000 ($56 million) in Iraq on wages, salaries, and other expenditures. 4/

(c) In 1961, Bahrain Petroleum Company (whose operations are on a much smaller scale than those of KOC or IPC) ordered goods from merchants in Bahrain valued at over 17 million Rupees ($3.5 million). Money paid for materials actually delivered by local merchants in 1960--which included a number of items ordered during the previous year--amounted to nearly 17 million Rupees ($3.5 million). 5/

(d) In 1961, the Iranian Oil Producing Company and the Iranian Oil Refining Company (the Consortium's operating companies in Iran) spent a total of £37,423,000 ($104.8 million) in Iran on wages and salaries, local purchases and payments to contractors, workers' social insurance, and on those customs duties and import taxes from which they were not exempt. Foreign exchange brought into Iran for the purpose of these expenditures amounted to about £35,350,000 ($99 million). 6/

(e) In 1961, the Arabian American Oil Company spent approximately $72 million in Saudi Arabia on wages and salaries for non-American employees, payments to local industry for goods and services, income tax paid by non-Saudi company employees, public welfare expenditures, on those customs duties from which it is not exempt, on freight, and on miscellaneous payments to the Government of Saudi Arabia.

(f) In 1961, Qatar Petroleum Company, a much smaller operation than all the companies already mentioned except Bapco, spent 9.5 million Rupees (about $2 million) on local purchases alone. 7/

C. Importance of Oil Income to the National Economies*

Oil income's contribution is felt principally in two ways: by providing revenues to the national government for budgetary use, and by adding to foreign exchange resources.

In Table 18-8, the total revenues respectively of the governments of Venezuela, Bahrain, Iran, Iraq, and Saudi Arabia are compared with these countries' direct incomes from oil over the period 1953-61. In all these countries, the proportion of total governmental revenues provided by direct income from oil has normally been in excess of 50 percent, and it has often been substantially in excess. (In the case of Iran, the years 1953-54--aftermath of the nationalization and 1959-60--large foreign grants in aid, cannot be regarded as normal.) Neither Kuwait nor Qatar has published budget information in the past, but there is reason to suppose that direct oil revenues probably account for upwards of 90 percent of Kuwait's budget, and the percentage in Qatar is certainly of the same order of magnitude.

The degree of importance represented by these percentages, and the overall contributions made by oil income, both direct and indirect, to foreign exchange resources, vary widely from country to country.

The position in Venezuela, Iran and Iraq differs fundamentally from that in other producer states. All three possess

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* This section relies heavily upon Oil Revenues and Middle East Economies, I & II, by John Murray, Petroleum Times, December 1 and 15, 1961.

TABLE 18-8

GOVERNMENT REVENUES (BUDGET) AND INCOME FROM OIL IN VENEZUELA & THE MIDDLE EAST a/
1953-1961
($U.S. Million And Income From Oil As Percent Of Govt. Revenues)

	1953	1954	1955	1956	1957	1958	1959	1960	1961
VENEZUELA									
Government Revenues*	820	852	968	1,417	1,748	1,523	1,761	1,605	1,926
Income from oil*	514	485	555	983	1,237	877	1,043	971	1,031
Percent of Government Revenue	62.7	56.9	57.3	69.4	70.8	57.6	59.2	60.5	53.5
BAHRAIN									
Government Revenues	8	14	15	15	15	16	16	15 b/	NA
Income from oil	5	11	9	10	10	12	13	13	13
Percent of Government Revenue	62.5	78.6	60.0	66.7	66.7	75.0	81.2	86.7	NA
IRAN									
Government Revenues	106	132	161	213	292	367	855	1,092	NA
Income from oil	-	9	91	153	213	272	262	285	291
Percent of Government Revenue	-	6.8	56.5	71.8	72.9	74.1	30.6	26.1	NA
IRAQ									
Government Revenues c/	234	280	327	301	265	372	388	NA	NA
Income from oil	144	191	206	193	144	237	242	266	266
Percent of Government Revenue	61.5	68.2	63.0	64.1	54.3	63.7	62.4	NA	NA
SAUDI ARABIA									
Government Revenues	305	NA	NA	NA	398	374	364	397	481
Income from oil	226	281	275	283	303	302	315	332	365
Percent of Government Revenue	74.1	NA	NA	NA	76.1	80.7	86.5	83.6	75.6

* Converted at $U.S. - Bs. 3.09.

a/ Oil income derived from Table 18-7 Government revenues: Venezuela, 1953-60 from 8/, 1961 from 9/, Bahrain, 10/, Iran, 11/, Iraq, 12/, Saudi Arabia, 13/.

b/ Estimated.

c/ Government Revenues in Iraq include 70 percent of oil income in 1953/1958 and 50 percent in 1959 as allocated to the Government Development Board, which is additive to the National Budget.

resources which could have formed the basis for some economic and social development, even in the absence of oil. Oil revenues have, however, provided a tremendous impetus to the development of these resources.

Venezuela, though intent in development of its other resources and on diversification of investment, remains essentially an oil-based economy. The oil sector not only provides more than 50 percent of government revenues in direct payments, but also contributes some 80 percent of foreign exchange earnings. For the welfare of the ordinary people, this fact gains importance by reason of the large imports of food.

In Iran, there is no doubt that the spending of the oil revenues (and of loans which only these are able to repay) has produced a considerable growth in the economy, together with a parallel rise in private investment. Excluding foreign aid or loans, income from the oil sector of the economy accounted for 66.8 percent of Iran's foreign exchange earnings in 1956-57, rising to 79.8 percent in 1958-59. Various factors have given rise to the present 18-months old economic crisis. A stabilization program, introduced in 1960, has had some effect, assisted by releases from U.S. loans and by West German help. Iran's situation, however, is still critical, and any reduction in its oil revenues could spell disaster for its efforts towards economic recovery.

In Iraq, planned capital expenditure has, for practical purposes, been wholly financed by oil revenues since 1952. Oil revenues further are to be the main prop of a new £556 million ($1,560 million), five-year economic development plan recently published in the Official Gazette and designed to double the country's national income within ten years. Of the total oil revenues for the period, estimated at £580 million ($1,620 million), about 54 percent will be allocated to the plan. [14] In 1960, when 61 percent of total Iraqi government revenues for general budget and development purposes came from oil, income from the oil sector of the economy accounted for 90 percent of Iraq's foreign exchange earnings, [15] thus forming the principal support for a huge import flow of £125 million ($350 million), much of it in capital goods necessary for development.

In Saudi Arabia and the Persian Gulf States, before the oil era, there was almost nothing on which to build wealth. Oil revenues have wrought spectacular changes in the economies and societies of those countries where oil has been found. Budgetary dependence on direct oil revenues is very high: in Saudi Arabia and Bahrain it is over 75 percent; in Kuwait and Qatar it is probably over 90 percent. Oil revenues in Kuwait, together with KOC's and Aminoil's local spending, probably comprise nearly 100 percent of Kuwait's foreign exchange income. The percentages in Saudi Arabia and Qatar are probably of the same order of magnitude. Bahrain is to some extent an exception: it re-exports about one-third of its imports, so that oil plays a considerably smaller proportionate part in the balance of payments.

D. Income Lost Due to Soviet Bloc Oil Exports

1. Direct Income

Table 18-9 contains data which measure the effect of increased volumes of Soviet Bloc oil exports upon the direct incomes of Venezuela and the governments of the Middle East.

It would, of course, be possible to estimate the income value, to Free World producer governments, of the loss of sales represented by total Soviet Bloc exports to the Free World. (From 1953 to 1961, the cumulative figure is probably about $590 million.) However, since the Soviet Bloc has always been an oil-exporting area, and could rely on special circumstances, such as long-standing obligations - e.g., reparations--or geographical proximity, to preserve some position in the Free World oil trade, it has been thought to be more realistic to select a base year as representing a norm. In 1953, the base year selected, Soviet Bloc oil exports were confined to Western Europe, and equalled 1.9 percent of oil demand in that area. The year of the death of Stalin, 1953, also saw a change in emphasis in Soviet economic policy, from maximum autarky to a growing reliance upon foreign trade to accelerate the development of the Bloc's resources.

In 1961, Soviet Bloc oil exports to the Free World approximated 30.5 million tons (610,000 barrels per day). If Soviet Bloc exports to Western Europe since 1953 had remained in line with their percentage share in that year, and there had been no penetration of other markets, the 1961 total Bloc exports would have been only 86,000 barrels per day, or 524,000 barrels per day (25.2 million tons) less than the actual total. In Table 18-9, this volume of 524,000 barrels per day, representing the size of the Free World markets lost in 1961 as a result of increased Soviet Bloc exports since 1953, has been apportioned

TABLE 18-9

VOLUME AND VALUE OF MIDDLE EAST AND VENEZUELAN OIL DISPLACED BY SOVIET BLOC OIL [a/]

1961

	VOLUME DISPLACED		VALUE	
	THOUSAND BARRELS PER DAY [b/]	MILLION BARRELS	$U.S./ BARREL	$U.S. MILLION
IN WESTERN EUROPE				
Middle East	259	94.1	0.69	64
Venezuela	49	17.9	0.97	17
TOTAL	308	112.0		81
IN AFRICA, ASIA AND OCEANIA				
Middle East	117	42.7	0.69	30
Venezuela	10	3.7	0.97	4
TOTAL	127	46.4		34
IN LATIN AMERICA				
Middle East	13	4.7	0.69	3
Venezuela	76	27.7	0.97	27
TOTAL	89	32.4		30
IN TOTAL FREE WORLD				
Middle East	389	141.5	0.69	97
Venezuela	135	49.3	0.97	48
TOTAL	524	190.8		145

a/ If the Bloc position in these markets in 1953 remained constant and if the Middle East and Venezuela shared the Bloc's increment proportionately to their 1961 position.

b/ Derived as follows:

	(THOUSAND BARRELS PER DAY)		
	PRELIMINARY ESTIMATE	IF BLOC WERE HELD AT 1953 POSITION	APPARENT GAIN IN MIDDLE EAST AND VENEZUELA/NWI EXPORTS
WESTERN EUROPE			
Demand	4,508	4,508	
Imports			
Soviet Bloc	394	86	
Middle East	3,113	3,372	259
Venezuela/NWI	578	627	49
TOTAL	4,085	4,085	308
AFRICA, ASIA AND OCEANIA			
Demand	2,763	2,763	
Imports			
Soviet Bloc	127	0	
Middle East	1,805	1,922	117
Venezuela/NWI	140	150	10
TOTAL	2,072	2,072	127
LATIN AMERICA			
Demand	1,700	1,700	
Imports			
Soviet Bloc	89	0	
Middle East	70	83	13
Venezuela/NWI	431	507	76
TOTAL	590	590	89

In 1953 Soviet exports to Western Europe represented 1.9 percent of the demand. There were no exports of Bloc oil to the other areas.

between the Middle East and Venezuela on the basis of their respective contributions to major oil imports made in 1961 by the three main geographical regions of the Free World which imported Soviet Bloc oil in that year. The value of such displaced oil (or potential Middle East or Venezuelan exports) has been estimated on the basis of the average direct income per barrel received by the Middle East and Venezuela respectively in 1961, as shown in Table 18-10. The approximate 1961 losses come to $97 million for the Middle East and $48 million for Venezuela.

An estimate of the annual and cumulative loss of direct income by Middle Eastern and Venezuelan governments over the period 1954-61, based on the same method as described above, is shown in Table 18-11. The final column of this table, reproduced below, shows a rapidly increasing level of losses from year to year, reaching in 1961 ten times the level of 1954.

	1953	1954	1955	1956	1957	1958	1959	1960	1961	1954-1961
Loss of Income by Middle East/ Venezuela ($U.S. Million)	-	15	19	25	34	52	83	117	145	490
Percent Increase/Year	-	-	27	31	36	53	59	41	24	38

The annual rate of increase shows signs of slackening off, but the absolute annual increase remains high. There appears to be little evidence of any reversal of the tendency for the losses to increase.

2. Other Expenditures

In the long run, a continued high level of Soviet Bloc oil exports to the Free World may also be expected to have an effect upon the incomes of producer states arising from oil companies' "other expenditures". The impact of increased Soviet Bloc oil exports on these "other expenditures" is not, of course, direct or immediate. The level of such expenditures is, however, in the long run, linked to the level of production, and to the general prosperity, of the oil producing companies. Loss of markets, therefore, is likely to have an eventual effect on "other expenditures."

TABLE 18-10

PRODUCTION OF CRUDE OIL AND OIL INCOME IN VENEZUELA AND THE MIDDLE EAST a/
1953 - 1961

	1953	1954	1955	1956	1957	1958	1959	1960	1961
VENEZUELA									
Crude Production (Thousand B/D)	1,765	1,896	2,157	2,457	2,779	2,605	2,771	2,846	2,920
Million Barrels	644	692	787	897	1,014	951	1,011	1,039	1,066
Income from Oil ($US Million)	514	485	555	983	1,237	877	1,043	971	1,031
$US per barrel	0.80	0.70	0.71	1.10	1.22	0.92	1.03	0.93	0.97
MIDDLE EAST									
Crude Production (Thousand B/D)	2,424	2,736	3,243	3,442	3,533	4,267	4,587	5,240	5,613
Million Barrels	899	997	1,184	1,256	1,269	1,557	1,674	1,911	2,048
Income from Oil ($US Million)	562	716	898	968	1,023	1,238	1,230	1,390	1,414
$US per barrel	0.63	0.72	0.76	0.77	0.81	0.80	0.73	0.73	0.69

a/ Oil Income from Table 18-7.

TABLE 18-11

LOSS OF INCOME TO THE MIDDLE EAST AND VENEZUELA DUE TO FREE WORLD IMPORTS OF SOVIET BLOC OIL
1954 - 1961

YEARS (A)	TOTAL BLOC EXPORTS TO THE FREE WORLD THOUSAND B/D (B)	TOTAL BLOC EXPORTS TO THE FREE WORLD MILLION BBLS. (C)	WESTERN EUROPE PETROLEUM DEMAND THOUSAND B/D (D)	1.9 PERCENT x W.E. PETROLEUM DEMAND THOUSAND B/D (E)	1.9 PERCENT x W.E. PETROLEUM DEMAND MILLION BBLS. (F)	AVERAGE INCOME ME/VENEZUELA a/ ($/BARREL) (G)	LOSS OF INCOME BY M.E./VENEZUELA ($U.S. MILLION) (COL.G x) (COL.C-COL.F)
1953	34	12	1,755	34	12	0.67	-
1954	97	35	2,019	38	14	0.72	15
1955	116	42	2,320	44	16	0.75	19
1956	139	51	2,644	50	18	0.76	25
1957	166	61	2,679	51	19	0.82	34
1958	235	86	3,097	59	22	0.82	52
1959	353	128	3,455	66	24	0.80	83
1960	486	178	4,000	76	28	0.78	117
1961	610	223	4,508	86	31	0.76	145
1954/1961							490

a/ Average Income to M.E./ Venezuela is weighted averaged of M.E.@ 75 percent and Venezuela @ 25 percent (roughly the 1961 average on Table 18-9) using $Bbl. data given on Table 18-10.

E. The Threat to Oil Export Prices

The loss of income resulting from a reduction in volume of sales is the only kind of loss caused to oil exporting countries by increased Soviet oil exports which can be reasonably estimated. However, the size of direct payments to the governments of Free World oil exporting countries not only depends upon the volume of exports, but also is related to F.O.B. selling prices. If Soviet price-cutting contributed to reduction in those prices, the levels of direct payments per barrel, as well as total direct payments, are automatically reduced.

Ample reliable evidence is given in an earlier section to show that, in many markets, the USSR has used substantial reductions in prices, below those which Free World suppliers consider economic, as its main means of obtaining or increasing its oil export business. This practice has inevitably increased existing pressure upon the F.O.B. selling prices. For example, though the degree of responsibility is not demonstrable, there can be no doubt that cut-price Soviet Bloc exports contributed to the reductions in Middle East posted prices which took place in February, 1959 and August, 1960.

Since few Free World markets are insulated from the effects of spreading price weakness, the impact of Soviet pricing policies is felt not merely by the Middle East and Venezuela, whose sales have been displaced, but by all oil exporting countries whose incomes depend upon the levels of selling prices. The threat of Soviet exports to the prices of oil exported by Free World producing countries, though incapable of exact evaluation, is thus of wider concern, and may be even more serious, than the threat to the actual volumes of Free World exports.

SECTION 50

SOVIET BLOC MARINE ACTIVITIES

A. Soviet Bloc Tanker Fleet

1. History of Fleet

In 1950, the Soviet fleet consisted of small vessels, most of them built prior to World War II, the largest vessel being 10,900 dwt. The total tonnage was only 174,000 a mere fraction of 1 percent of total world tanker tonnage. Also the Satellite fleet was extremely small.

It was only in 1953 that the USSR started building up her fleet. Two main types of vessels were put into service, a 12,000 dwt vessel built in Soviet shipyards, and a 4,000 dwt vessel built in Finland and Bulgaria. It is believed the latter type of vessel is used for some of the short hauls from Klaipeda in the Baltic to destinations bordering that sea, e.g., Sweden, Finland, etc. Other vessels of this type, together with vessels of smaller tonnage, are also used in Soviet inland seas, coastal waters, lakes, and rivers.

By 1956, Soviet shipyards were turning out eleven 12,000 dwt vessels per year, the total tanker tonnage built in the USSR in that year being 136,000 dwt. In 1958, when the Soviet oil offensive was beginning to get into its stride, the first "super-tanker" was laid-down. This was the "Pekin" of 29,000 dwt which went into service in 1959. A comparatively high service speed of 18.5 knots for this vessel is to be noted. Three other ships of this size followed during 1960 and 1961, and in 1960 the USSR started acquiring tankers from Free World shipyards.

2. Current Fleet

The Soviet Bloc owned tankers, together with the Yugoslav fleet, as of September 1, 1962 are given in detail in Tables 18-12, 18-13, and 18-14, and are summarized below:

TABLE	TITLE	T-2 EQUIVALENT	DWT
18-12	Soviet Bloc Flag Tankers in Petroleum Service	90.7	1,556,061
18-13	Soviet Bloc Flag Tankers Not Reported in Ocean Petroleum Trade	14.7	302,349
18-14	Yugoslavian Flag Tankers in Petroleum Service	4.3	82,106
	TOTAL OPERATING	109.7	1,940,516

The Yugoslav fleet has been included in the Soviet Bloc availability inasmuch as a study of trade statements indicates that a major portion of their trade is into the Black Sea.

Combination USSR flag ore/oil carriers shown on Table 18-14 have been excluded from availability since the portion of their time during which they are engaged in petroleum trade is unknown.

As shown above, the current Soviet Bloc flag tanker fleet totals 105.4 T-2 equivalents. Of this total, tonnage equivalent to 41.8 T-2 equivalents has been built in Free World countries. Thus, the Bloc has been dependent on the Free World for 40 percent of its current fleet.

3. USSR Seven Year Plan

When the Seven Year Plan (1959 through 1965) was announced in 1958, the stated intention was to increase the size of the tanker fleet by 80 percent during the Plan. Thus the Soviet fleet would have to increase from 819,000 dwt at the end of 1958 to 1,474,000 dwt (about 90 T-2 equivalents) at the end of 1965, by which time it was planned that 40 percent of the fleet would consist of so-called "super-tankers". The 29,000 dwt "Pekin" and three sister ships that have been put into service are apparently in the "super-tanker" class. While the Soviet Union has started building these "super-tankers", her launchings of the smaller 12,000 dwt ships have fallen.

TABLE 18-12

SOVIET BLOC FLAG TANKERS
AS OF SEPTEMBER 1, 1962

VESSELS REPORTED IN PETROLEUM SERVICE

6,000 DWT AND OVER

USSR FLAG

	NAME	YEAR BUILT	D.W.T.	GROSS	SPEED	"T-2" EQUIV.	
	MS ADLER	1960	25,000	16,249	15.75	1.625	
	MS AGAMALI OGLI	1930	9,000	6,092	10.00	.371	
	MS APSHERON	1952	13,250	9,047	14.00	.765	
(1)	MS ASHKHABAD	1954	12,000	8,229	12.50	.623	Last Reptd Istanbul 4/9/62
(2)	MS BALAKLAVA	1962	19,000	13,365	15.00	1.184	
(2)	MS BAUSKA	1962	19,000	13,269	15.00	1.184	
(1)	MS BELGOROD	1957	12,000	8,229	12.50	.623	
(3)	MS BUCHAREST	1962	29,000	21,255	18.50	2.229	
(3)	SS BUDAPEST	1960	29,000	21,255	18.50	2.229	
(1)	MS BUGULMA	1957	12,000	8,229	12.50	.623	
(1)	MS BUGURUSLAN	1958	12,000	8,229	12.50	.623	
(1)	MS CHEBOKSSARY	1957	12,000	8,229	12.50	.623	Ex-Andrey Vishinsky
(1)	MS CHERNOVSKI	1955	12,000	8,229	12.50	.623	
(1)	MS CHKALOV	1956	12,000	8,229	12.50	.623	
	SS DRUZHBA	1960	40,000	25,718	16.00	2.641	
(1)	MS DZERJINSK	1956	12,000	8,229	12.50	.623	
(1)	MS ELBRUS	1959	12,000	8,299	12.50	.623	
(1)	MS FRIEDRICH ENGELS	1957	12,000	8,229	12.50	.623	
(1)	MS FRUNZE	1955	12,000	8,229	12.50	.623	
	SS GIUSEPPE GARIBALDI	1961	31,500	20,659	16.00	2.080	
(1)	MS GORKY	1955	12,000	8,229	12,50	.623	
(1)	MS GREGORY VAKULENTCHUK	1955	12,000	8,229	12.50	.623	
(1)	MS GRODNO	1956	12,000	8,229	12.50	.623	
(1)	MS GROSNY	1954	12,000	8,229	12.50	623	
	MS GURZUF	1961	24,950	16,349	15.75	1.621	
(1)	MS IVANOVO	1956	12,000	8,229	12.50	.623	
(1)	MS IZJASLAV	1960	12,000	8,229	12.50	.623	
(1)	MS JDANOV	1955	12,000	8,229	12.50	.623	
(1)	MS KAKHOVKA	1954	12,000	8,229	12.50	.623	
(1)	MS KARL MARX	1957	12,000	8,229	12.50	.623	
(1)	MS KAUNAS	1956	12,000	8,229	12.50	.623	
(1)	MS KERCH	1954	12,000	8,229	12.50	.623	
(1)	MS KHERSON	1953	12,000	8,229	12.50	.623	
(1)	MS KLAIPEDA	1954	12,000	8,229	12.50	.623	
(1)	MS KOMSOMOL	1957	12,000	8,229	12.50	.623	
(1)	MS KOMSOMOLETS UKRANIA	1959	12,000	8,229	12.50	.623	
(1)	MS KOSTROMA	1955	12,000	8,229	12.50	.623	
(1)	MS KRASNOVODSK	1956	12,000	8,229	12.50	.623	
(1)	MS KREEMENETCHUG	1960	12,000	8,229	12.50	.623	
(1)	MS KURSK	1957	12,000	8,229	12.50	.623	
(4)	MS LEBEDIN	1962	35,000	22,000	16.00	2.327	
(1)	MS LENINGRAD	1953	12,000	8,229	12.50	.623	
(1)	MS LENINSK	1956	12,000	8,229	12.50	.623	
(4)	MS LENKORAN	1962	35,000	23,159	16.00	2.327	
(1)	MS LIEPAJA	1960	12,000	8,229	12.50	.623	
(4)	MS LISKHANSK	1962	35,000	23,153	16.00	2.327	
(4)	MS LUGANSK	1962	35,000	22,262	16.00	2.327	
(1)	MS MAHACHCALA	1954	12,000	8,229	12.50	.623	
	SS MIR	1960	39,100	25,063	16.50	2.662	
(1)	MS MOLODETCHNO	1956	12,000	8,229	12.50	.623	
(1)	MS MOSKOVSKY FESTIVAL	1957	12,000	8,229	12.50	.623	
	MS MOSKVA	1931	9,000	6,200	10.00	.371	
(1)	MS OCHAKOV	1955	12,000	8,229	12.50	.623	Last Reptd Istanbul 6/29/62
(3)	SS PEKIN	1959	29,000	21,255	18,50	2.229	
(1)	MS PENZA	1955	12,000	8,229	12.50	.623	
(1)	MS PETR SHISKHOV	1958	12,000	8,229	12.50	.623	
(3)	SS PRAGA	1961	29,000	21,255	18.50	2.229	
(1)	MS RAVA RUSSKAYA	1961	12,000	8,229	12.50	.623	
(1)	MS ROSTOV	1956	12,000	8,229	12.50	.623	
(1)	MS ROVNO	1960	12,000	8,229	12.50	.623	

TABLE 18-12 (Cont'd)

VESSELS REPORTED IN PETROLEUM SERVICE (CTD.)

	NAME	YEAR BUILT	D.W.T.	GROSS	SPEED	"T-2" EQUIV.	
	USSR FLAG (CTD.)						
(1)	MS SAMARKAND	1955	12,000	8,229	12.50	.623	
(1)	MS SLAVGOROD	1956	12,000	8,229	12.50	.623	
(1)	MS STANISLAV	1957	12,000	8,229	12.50	.623	
(1)	MS SUMY	1960	12,000	8,229	12.50	.623	
(1)	MS SVERDLOVSK	1954	12,000	8,229	12.50	.623	
(1)	MS TALLIN	1954	12,000	8,229	12.50	.623	
(1)	MS TBILISI	1959	12,000	8,229	12.50	.623	
	SS TRUD	1960	25,000	17,860	17.50	1.818	
	MS URAL	1956	8,000	6,377	10.00	.330	
(1)	MS UZHGOROD	1958	12,000	8,229	12.50	.623	
(3)	SS VARSHAVA	1960	29,000	21,255	18.50	2.229	
(1)	MS VINNIGA	1957	12,000	8,229	12.50	.623	
(1)	MS VLADIMIR	1957	12,000	8,229	12.50	.623	
(1)	MS YELNA	1959	12,000	8,229	12.50	.623	
(1)	MS YELSK	1960	12,000	8,229	12.50	.623	
(1)	MS YESSENTUKI	1959	12,000	8,229	12.50	.623	
(1)	MS ZHITOMIR	1957	12,000	8,229	12.50	.623	
	TOTAL USSR FLAG (77)		1,219,800			71.993	
	POLISH FLAG						
(5)	MS BESKIDY	1961	19,350	13,500	14.50	1.158	
(5)	MS KARPATY	1959	20,259	13,479	15.00	1.254	
	MS KASPROWY	1945	13,510	8,528	12.50	.697	
	MS ORNAK	1947	13,100	8,207	13.00	.703	
	MS ZAWRAT	1944	12,730	8,454	13.00	.683	
	TOTAL POLISH FLAG (5)		78,949			4.495	
	BULGARIAN FLAG						
	MS ANTON IVANOV	1945	12,760	8,442	13.00	.684	Last Reptd Gibraltar 4/24/62
	MS MARITZA	1949	15,482	10,098	11.50	.735	
	MS YANTRA	1952	15,530	10,094	13.00	.833	Last Reptd Hamburg 6/17/62
	TOTAL BULGARIAN FLAG (3)		43,772			2.252	
	EAST GERMAN FLAG						
(1)	MS BOHLEN	1961	12,000	8,229	12.50	.623	
(1)	MS LEUNA I	1957	12,000	8,229	12.50	.623	
(1)	MS LEUNA II	1958	12,000	8,229	12.50	.623	
	MS NUNA	1953	18,250	11,876	15.25	1.148	
(1)	MS SCHWEDT	1962	12,000	8,229	12.50	.623	
(1)	MS ZEITZ	1961	12,000	8,229	12.50	.623	
	TOTAL E.GERMAN FLAG (6)		78,250			4.263	
	CZECHOSLOVAKIAN FLAG						
(5)	MS OSTRAVA	1959	19,250	13,339	15.00	1.194	
	RUMANIAN FLAG						
	MS PACE	1957	19,020	12,349	15.00	1.177	
	MS PRIETENIE	1957	19,020	12,349	15.00	1.177	
	TOTAL RUMANIAN FLAG (2)		38,040			2.354	
SUB-TOTAL - BLOC - REPORTED 6,000 DWT AND ABOVE (94)			1,478,061			86.551	

TABLE 18-12 (Cont'd)

VESSELS REPORTED IN PETROLEUM SERVICE (CTD.)

4,000 THROUGH 5,999 DWT

USSR FLAG

NAME	YEAR BUILT	D.W.T.	KNOTS
ABAGUR	1962	5,000	14.0
AKSAJ	1961	4,000	12.0
ALAGIR	1961	4,000	12.0
ALEJSK	1962	4,000	12.0
ALEKSIN	1962	5,000	14.0
ARTEM	1959	4,000	12.0
ARTSYZ	1962	5,000	14.0
BALTA	1959	4,000	12.0
DALNIJ	1960	4,000	12.0
DJEBRAIL	1961	5,000	14.0
ELGAVA	1961	4,000	12.0
KOKAND	1959	4,000	12.0
LOKBATAN	1956	4,000	12.0
LUBERTSY	1962	5,000	14.0
NEFTECHALA	1960	5,000	14.0
TUKUM	1962	4,000	14.0
UDZHARY	1961	4,000	12.0
VENTSPILS	1959	4,000	12.0
SUB-TOTAL BLOC - REPORTED 4,000 THROUGH 5,999 DWT (18)		78,000	4.143 "T-2's"
GRAND TOTAL REPORTED IN PETROLEUM SERVICE (112)		1,556,061	90.694

(1) - "KAZBEK" CLASS - 69 SHIPS
(2) - "BAUSK" " - POLISH BUILT - 2 SHIPS
(3) - "PEKIN" " - USSR BUILT - 5 SHIPS
(4) - "LISKHANSK" " - JAPANESE BUILT - 4 SHIPS
(5) - "KARPATY" " - YUGOSLAVIAN BUILT - 4 SHIPS

TABLE 18-13

SOVIET BLOC FLAG TANKERS
AS OF SEPTEMBER 1, 1962

VESSELS NOT REPORTED IN OCEAN-GOING PETROLEUM TRADE

6,000 DWT AND OVER

	NAME	YEAR BUILT	D.W.T.	GROSS	SPEED	"T-2" EQUIV.	
	USSR FLAG						
	MS BATUMI	1932	8,150	6,236	11.50	.387	Assigned to Soviet Far East
(1)	MS EGORJEVSK	1959	12,000	8,229	12.50	.623	Note "A"
	MS JOSIF STALIN	1932	10,000	7,745	10.00	.413	Last Reptd Istanbul 1/21/62
(1)	MS KAZBEK	1954	12,000	8,229	12.50	.623	" " " 11/13/62
(1)	MS KIROV	1955	12,000	8,229	12.50	.623	" " " 3/1/62
	MS KREML	1932	12,000	7,661	10.00	.495	Assigned to Soviet Far East
(1)	MS MAIKOP	1953	12,000	8,229	12.50	.623	Last Reptd Istanbul 10/18/61
(1)	MS MOSKALVO	1961	12,000	8,229	12.50	.623	Assigned to Soviet Far East
	MS PAMIR	1927	9,160	6,662	10.50	.397	" " " " "
(1)	MS POTI	1954	12,000	8,229	12.50	.623	Last Reptd Istanbul 9/24/61
	MS SERGO	1930	11,460	7,990	10.50	.496	Assigned to Soviet Far East
	MS SOVETSKAYA NEFT	1929	10,900	8,229	11.00	.495	" " " " "
(1)	MS TUAPSE	1953	12,000	8,229	12.50	.623	Note "B"
	MS VAILLANT CUTURIER	1930	10,000	7,602	10.00	.413	Assigned to Soviet Far East
(1)	MS VOLGA DON	1953	12,000	8,229	12.50	.623	Last Reptd Istanbul 7/30/61
	TOTAL USSR FLAG (15)		167,670			8.080	
	RED CHINESE FLAG						
	MS CHIEN SHE 13	1937	14,820	9,929	12.00	.734	Movements Unknown
	MS CHIEN SHE 14	1945	12,835	8,272	12.00	.636	Movements Unknown
	TOTAL RED CHINESE FLAG (2)		27,655			1.370	
	BULGARIAN FLAG (1)						
	MS ARDA	1950	12,234	8,322	11.00	.555	Last Reptd Istanbul 7/18/61
	POLISH FLAG (1)						
	SS PRACA	1921	12,020	8,410	10.00	.496	Note "B"
	EAST GERMAN FLAG						
	MS LUTZKENDORF	1946	13,360	8,615	13.00	.717	Movements Unknown
	MS SCHWARZHEIDE	1947	13,410	8,650	13.00	.719	Movements Unknown
	TOTAL EAST GERMAN FLAG (2)		26,770			1.436	
	MOVEMENTS UNREPORTED 6,000 DWT AND ABOVE (21)		246,349			11.937	

TABLE 18-13 (Cont'd)

UNREPORTED, ASSUMED TO BE IN BLACK SEA/BULGARIAN TRADE

4,000 to 5,999 DWT

NAME	YEAR BUILT	D.W.T.	KNOTS	
BESKIDY	1957	4,000	12.0	
BOLSHEVIK KARAVNY	1959	4,000	12.0	
FEDYA GUBANOV	1959	4,000	12.0	
GYURGYAN	1960	4,000	12.0	
KHOVY	1961	4,000	12.0	
KOMSOMOLETS PRIMORJA	1960	4,000	12.0	
MOZYR	1959	4,000	12.0	
PAMYAT 26 KOMISAR	1959	4,000	12.0	
PEVEK	1958	4,000	12.0	
PIRJATIN	1960	4,000	12.0	
RION	1958	4,000	12.0	
TATRY	1957	4,000	12.0	
VILJUISK	1958	4,000	12.0	
ZOLOTOJ ROG	1960	4,000	12.0	
SUB-TOTAL (14)		56,000		2.773 "T-2's"
GRAND TOTAL - BLOC FLAG TANKERS NOT REPORTED (35)		302,349		14.710

USSR FLAG - ORE/OIL CARRIERS

NAME	YEAR BUILT	D.W.T.	GROSS	SPEED	"T-2" EQUIV.	
MS DANGARA	1961	9,500	7,265	14.3	.561	
MS DEBALZEVO	1960	9,500	7,265	14.3	.561	
MS DOLMATOVO	1960	9,500	7,265	14.3	.561	
MS DOBROPOLJE	1961	9,500	7,265	14.3	.561	
MS DOBRUSH	1960	9,500	7,265	14.3	.561	
MS DOROGOBUSH	1961	9,500	7,265	14.3	.561	
MS DSHANKOI	1960	9,500	7,265	14.3	.561	
MS DUBNO	1960	9,500	7,265	14.3	.561	
MS DUBOSARY	1960	9,500	7,265	14.3	.561	
MS DUDINKA	1961	9,500	7,265	14.3	.561	
TOTAL TANK/ORE CARRIERS (10)		95,000			5.610	Note "C"

(1) - "KAZBEK" CLASS - 69 SHIPS
"A" - REPORTED ON FIRE AT ODESSA 2/6/61
"B" - HELD BY CHINESE NATIONALIST GOVERNMENT, MOVEMENTS UNKNOWN.
"C" - SINCE THE PORTION OF TIME ORE/OIL CARRIERS ARE ENGAGED IN PETROLEUM TRADE IS UNKNOWN, THEY ARE NOT INCLUDED IN AVAILABLE OIL TANKER FLEET.

TABLE 18-14

YUGOSLAVIAN FLAG TANKERS AS OF SEPTEMBER 1, 1962

VESSELS REPORTED IN PETROLEUM SERVICE

6,000 DWT AND OVER

	NAME	YEAR BUILT	D.W.T.	GROSS	SPEED	"T-2" EQUIV.
	MS ALAN	1950	13,000	8,223	13.00	.697
(5)	MS IZ	1960	20,100	12,770	15.00	1.244
	MS JAJCE	1943	11,870	8,318	12.00	.588
	MS LENDAVA	1934	12,280	8,159	11.50	.583
	MS MOLAT	1950	12,910	8,631	12.00	.639
	MS PROGRESS	1944	11,946	8,318	12.00	.591
	TOTAL REPORTED (6)		82,106			4.342

In addition there is one Yugoslavian Flag tanker being converted to dry cargo: M.S. "RUDO" (EX-ATLANTIC EAGLE") built 1951 - 14,916 DWT - 13.00 Knots - .800 "T-2's".

(5) - KARPATHY" CLASS - Yugoslavian Built - 4 Ships.

4. New Construction in the Soviet Bloc for the Bloc

As of September 1, 1962, orders for new construction in the Soviet Bloc yards totaled 23 ships equivalent to 42.3 T-2's. The details of these orders are given in Table 18-15 and are summarized below:

	NUMBER OF SHIPS OF EACH D.W.T. CLASS					TOTAL	
LOCATION	15/16,000	19/20,000	30/37,000	47,000	TOTAL	D.W.T.	T-2 EQUIVALENT
USSR	2	3	3	6	14	470,400	31.6
Poland	-	9	-	-	9	171,000	10.7
TOTAL	2	12	3	6	23	641,400	42.3

5. New Buildings in the Free World for the Bloc

A new factor entered into the USSR's tanker expansion program in 1960 when she started acquiring new tankers by buying new buildings originally ordered by Free World independent tanker operators and by placing new orders in Free World yards. As of September 1, 1962, orders for new construction in the Free World yards for the USSR totaled 51 ships equivalent to 82.4 T-2's. This is twice the tonnage that the Bloc is building in its own yards and emphasizes the assistance the Free World is giving to the Bloc in the latter's oil offensive. The details of these orders are given in Table 18-16 and are summarized below:

	NUMBER OF SHIPS OF EACH D.W.T. CLASS					TOTAL	
LOCATION	5,000	25,000	35,000	48,000	TOTAL	D.W.T.	T-2 EQUIVALENT
Japan			14		14	490,000	32.6
Italy				6	6	288,000	19.7
Finland	15				15	75,000	4.4
Yugoslavia		16			16	400,000	25.7
TOTAL	15	16	14	6	51	1,253,000	82.4

TABLE 18-15

SOVIET BLOC - NEW CONSTRUCTION - ON ORDER - BLOC YARDS
AS OF SEPTEMBER 1, 1962

	YARD	HULL	FLAG	D.W.T.	SPEED	"T-2"	
SEPT./DEC. - 1962							
BALTIC, LENINGRAD	USSR	-	USSR	30,500	16.0	2.027	"Ulan Bator" - launched May '62
ORDHONIKIDZE, LENINGRAD	USSR	-	USSR	15,000	16.0	.997	
TOTAL BALANCE - 1962 (2SHIPS)				45,500		3.024	
1963							
ADMIRALITATSWERFT, LENINGRAD	USSR	-	USSR	20,000	15.5	1.288	
ORDHONIKIDZE, LENINGRAD	USSR	-	USSR	47,000	16.5	3.222	
ORDHONIKIDZE, LENINGRAD	USSR	-	USSR	47,000	16.5	3.222	
ORDHONIKIDZE, LENINGRAD	USSR	-	E.GERM.	16,200	15.0	1.010	
NOSENKO, NICOLAIEFF	USSR	-	USSR	36,700	16.0	2.440	
STOCZNIA, GDANSKA	POLAND	-	USSR	19,000	15.0	1.184	
TOTAL 1963 (6 SHIPS)				185,900		12.366	
1964							
STOCZNIA, GDANSKA	POLAND	-	R.CHINA	19,000	15.0	1.184	
ADMIRALITATSWERFT, LENINGRAD	USSR	-	USSR	20,000	15.5	1.288	
ADMIRALITATSWERFT, LENINGRAD	USSR	-	USSR	47,000	16.5	3.222	
ORDHONIKIDZE, LENINGRAD	USSR	-	USSR	30,000	16.0	1.944	
BALTIC, LENINGRAD	USSR	-	USSR	47,000	16.5	3.222	"Sophia" - Keel laid, June '62
STOCZNIA, GDANSKA	POLAND	-	USSR	19,000	15.0	1.184	
STOCZNIA, GDANSKA	POLAND	-	USSR	19,000	15.0	1.184	
STOCZNIA, GDANSKA	POLAND	-	USSR	19,000	15.0	1.184	
TOTAL 1964 (8 SHIPS)				220,000		14,412	
1965							
STOCZNIA, GDANSKA	POLAND	-	R.CHINA	19,000	15.0	1.184	
ADMIRALITATSWERFT, LENINGRAD	USSR	-	USSR	20,000	15.5	1.288	
ORDHONIKIDZE, LENINGRAD	USSR	-	USSR	47,000	16.5	3.222	
ORDHONIKIDZE, LENINGRAD	USSR	-	USSR	47,000	16.5	3.222	
STOCZNIA, GDANSKA	POLAND	-	USSR	19,000	15.0	1.184	
STOCZNIA, GDANSKA	POLAND	-	USSR	19,000	15.0	1.184	
STOCZNIA, GDANSKA	POLAND	-	USSR	19,000	15.0	1.184	
TOTAL 1965 (7 SHIPS)				190,000		12.468	
GRAND TOTAL - BLOC YARDS (23 SHIPS)				641,400		42.270	
GRAND TOTAL - AVAILABLE THROUGH MID YEAR 1965						36.036	

TABLE 18-16

SOVIET BLOC - NEW CONSTRUCTION - ON ORDER - FREE WORLD YARDS
AS OF SEPTEMBER 1, 1962

	YARD	HULL	FLAG	D.W.T.	SPEED	"T-2"	
SEPT./DEC. - 1962							
BRODOGRADILISTE, PULA	YUGO.	-	USSR	25,000	15.5	1.610	
BRODOGRADILISTE, SPLIT	YUGO.	-	USSR	25,000	15.5	1.610	
BRODOGRADILISTE, SPLIT	YUGO.	-	USSR	25,000	15.5	1.610	
ISHIKAWAHIMA, HARIMA	JAPAN	0593	USSR	35,000	16.0	2.327	"Ljubotin" - launched June "62
TOTAL SEPT./DEC. - 1962 (4 SHIPS)				110,000		7.157	
1963							
ISHIKAWAHIMA, HARIMA	JAPAN	0594	USSR	35,000	16.0	2.327	
ISHIKAWAHIMA, HARIMA	JAPAN	-	USSR	35,000	16.0	2.327	
MITSUBISHI, HIROSHIMA	JAPAN	-	USSR	35,000	16.0	2.327	
MITSUBISHI, HIROSHIMA	JAPAN	-	USSR	35,000	16.0	2.327	
ANSALDO, GENOA	ITALY	1593	USSR	48,000	16.5	3.290	
RAUMA - REPOLA	FINLAND	0124	USSR	5,000	14.0	.291	"Anapa" - launched Feb. '62
RAUMA - REPOLA	FINLAND	0125	USSR	5,000	14.0	.291	"Sinegorsk" - " Apr. '62
RAUMA - REPOLA	FINLAND	0126	USSR	5,000	14.0	.291	
RAUMA - REPOLA	FINLAND	0127	USSR	5,000	14.0	.291	
RAUMA - REPOLA	FINLAND	0128	USSR	5,000	14.0	.291	
BRODOGRADILISTE 3, RIJEKA	YUGO.	-	USSR	25,000	15.5	1.610	
BRODOGRADILIATE 3, RIJEKA	YUGO.	-	USSR	25,000	15.5	1.610	
BRODOGRADILISTE, PULA	YUGO.	-	USSR	25,000	15.5	1.610	
BRODOGRADILISTE, PULA	YUGO.	-	USSR	25,000	15.5	1.610	
BRODOGRADILISTE, SPLIT	YUGO.	-	USSR	25,000	15.5	1.610	
BRODOGRADILISTE, SPLIT	YUGO.	-	USSR	25,000	15.5	1.610	
TOTAL - 1963 (16 SHIPS)				363,000		23.713	
1964							
ISHIKAWAHIMA, HARIMA	JAPAN	-	USSR	35,000	16.0	2.327	
ISHIKAWAHIMA, HARIMA	JAPAN	-	USSR	35,000	16.0	2.327	
ISHIKAWAHIMA, HARIMA	JAPAN	-	USSR	35,000	16.0	2.327	
ISHIKAWAHIMA, HARIMA	JAPAN	-	USSR	35,000	16.0	2.327	
MITSUBISHI, HIROSHIMA	JAPAN	-	USSR	35,000	16.0	2.327	
MITSUBISHI, HIROSHIMA	JAPAN	-	USSR	35,000	16.0	2.327	
ANSALDO, GENOA	ITALY	1594	USSR	48,000	16.5	3.290	
ANSALDO, LA SPEZIA	ITALY	1595	USSR	48,000	16.5	3,290	
ANSALDO, LA SPEZIA	ITALY	1596	USSR	48,000	16.5	3.290	
CANTIERI RIUNITI MONFALCONE	ITALY	1597	USSR	48,000	16.5	3.290	
RAUMA, REPOLA	FINLAND	0129	USSR	5,000	14.0	.291	
RAUMA, REPOLA	FINLAND	0130	USSR	5,000	14.0	.291	
RAUMA, REPOLA	FINLAND	0131	USSR	5,000	14.0	.291	
RAUMA, REPOLA	FINLAND	0132	USSR	5,000	14.0	.291	
RAUMA, REPOLA	FINLAND	0133	USSR	5,000	14.0	.291	
BRODOGRADILISTE, PULA	YUGO.	-	USSR	25,000	15.5	1.610	
BRODOGRADILISTE, PULA	YUGO.	-	USSR	25,000	15.5	1.610	
BRODOGRADILISTE 3, RIJEKA	YUGO.	-	USSR	25,000	15.5	1.610	
BRODOGRADILISTE 3, RIJEKA	YUGO.	-	USSR	25,000	15.5	1.610	
BRODOGRADILISTE, SPLIT	YUGO.	-	USSR	25,000	15.5	1.610	
BRODOGRADILISTE, SPLIT	YUGO.	-	USSR	25,000	15.5	1.610	
TOTAL - 1964 (21 SHIPS)				577,000		38.237	
1965							
ISHIKAWAHIMA, HARIMA	JAPAN	-	USSR	35,000	16.0	2.327	
MITSUBISHI, HIROSHIMA	JAPAN	-	USSR	35,000	16.0	2.327	
MITSUBISHI, HIROSHIMA	JAPAN	-	USSR	35,000	16.0	2.327	
CANTIERI RIUNITI MONFALCONE	ITALY	1598	USSR	48,000	16.5	3.290	
RAUMA, REPOLA	FINLAND	0134	USSR	5,000	14.0	.291	
RAUMA, REPOLA	FINLAND	0135	USSR	5,000	14.0	.291	
RAUMA, REPOLA	FINLAND	0136	USSR	5,000	14.0	.291	
RAUMA, REPOLA	FINLAND	0137	USSR	5,000	14.0	.291	
RAUMA, REPOLA	FINLAND	0138	USSR	5,000	14.0	.291	
BRODOGRADILISTE 3, RIJEKA	YUGO.	-	USSR	25,000		1.610	
TOTAL - 1965 (10 SHIPS)				203,000		13,336	
GRAND TOTAL - FREE WORLD YARDS (51 SHIPS)				1,253,000		82.443	
GRAND TOTAL - AVAILABLE THROUGH MID YEAR 1965						75.775	

In addition to the above buildings in the Yugoslav yards for USSR flag, there are two 32,000 dwt ships being built in Yugoslavia for Yugoslav flag (see Table 18-17).

All of the Soviet Bloc buildings in the Free World are currently for the account of the USSR.

It is not known to what extent barter arrangements are involved in the procurement of tankers. However, it should be noted that one of the many aims leading to the export of Soviet oil to industrialized countries such as Italy and Japan is to obtain industrial plant and equipment in return. Tankers are one of the more obvious items which are available.

6. USSR Seven Year Plan to be Exceeded

As noted in paragraph 3 above, the USSR planned to have an ocean fleet of 1,474,000 dwt or 90 T-2 equivalents at the end of 1965. Currently known new buildings would bring the USSR fleet to:

	EQUIVALENT T-2'S BY THE END OF 1965
Present USSR Fleet - Reported in Trade	
6,000 dwt and above	72.0
4,000 - 6,000 dwt	4.1
Present USSR Fleet - Unreported	
6,000 dwt and above	8.1
4,000 - 6,000 dwt (assumed Black Sea service)	2.8
New Construction for USSR - Bloc Yards	38.9
New Construction for USSR - Free World Yards	82.4
TOTAL	208.3
Less Assumed Scrappage*	3.8
	204.5

*Scrapping includes all vessels whether trading or unreported built prior to 1933.

Thus it can be seen that the USSR places so much importance on having an adequate fleet that the size of the fleet will increase about four-fold in the years 1959-65 although the Seven Year Plan goal was for an increase of only 80 percent.

TABLE 18-17

YUGOSLAVIAN FLAG NEW CONSTRUCTION
ON ORDER AS OF SEPTEMBER 1, 1962

	YARD	HULL	FLAG	DWT	SPEED	"T-2"	
SEPTEMBER/DECEMBER, 1962 - YUGOSLAVIAN FLAG							
BRODOGRADILISTE 3, RIJEKA	YUGOSLAVIAN	0474	YUGOSLAVIAN	32,000	15.5	2.061	"Vlasina" - launched August 1961
BRODOGRADILISTE 3, RIJEKA	YUGOSLAVIAN	0473	YUGOSLAVIAN	32,000	15.5	2.061	"Sevojno" - launched February 1961
TOTAL - SEPTEMBER/DECEMBER, 1962 - YUGOSLAVIAN FLAG (2 SHIPS)				64,000		4.122	

7. Bloc Requirements vs. Availability 1965

a. Requirements

In other sections of this report it has been pointed out that, in the absence of corrective action, Bloc exports to the Free World could reach 51,000,000 tons. This level of exports to the Free World, together with estimated intra-Bloc trade, would result in a tanker requirement to move 52,000,000 tons annually or 1,040,000 b/d. On this basis, requirements for 1965 are estimated at about 274 T-2 equivalents as shown in Table 18-18.

b. Known Availability

Known availability through mid-year 1965 (assumed equal to average availability for 1965) is as follows:

	T-2 EQUIVALENT
Bloc Fleet - Existing* (in service)	90.7
Yugoslav Fleet - Existing	4.3
Known new construction - Bloc Yards	36.0
Yugoslav Yards - Yugoslav Fleet	4.1
Free World Yards	75.8
	210.9
Less Scrappage**	.7
Known Mid-year 1965 Availability	210.2

*Including tankers 4,000 dwt and over. This does not include vessels that are unreported by Lloyd's in any trade. These vessels are presumed to be moving crude and products in restricted local or government service.

**Scrapping includes all vessels built prior to 1933 and reported in trade. While this is not the standard 20-year period normally used, it is believed that the Soviet Bloc shortage of tonnage would require them to continue to operate vessels which might be considered obsolete in the Free World.

TABLE 18-18

ESTIMATED TANKER TRANSPORTATION REQUIRED DURING 1965
FOR COMMUNIST BLOC MOVEMENTS TO OWN & FREE WORLD AREAS

	FROM USSR				FROM SATELLITES		TOTAL	
	CRUDE		PRODUCTS		PRODUCTS			
	MILLION TONS	T-2	MILLION TONS	T-2	MILLION TONS	T-2	MILLION TONS	T-2
EX BLACK SEA								
To Bloc								
Far East	-	-	2.2	24.1			2.2	24.1
To Free World								
North Europe	1.1	6.8	-	-	1.0	6.0	2.1	12.8
Western & Central Europe	-	-	2.0	10.6	0.7	3.8	2.7	14.4
Southern Europe & North Africa	9.0	28.6	3.0	8.7	0.5	1.6	12.5	38.9
Other Africa & Far East	6.7	74.4	2.5	27.1	-	-	9.2	101.5
Western Hemisphere	5.8	53.5	1.2	10.4	-	-	7.0	63.9
Total to Free World	22.6	163.3	8.7	56.8	2.2	11.4	33.5	231.5
Total Ex Black Sea	22.6	163.3	10.9	80.9	2.2	11.4	35.7	255.6
Less One Day Port Time Black Sea		(4.9)		(1.7)		(0.4)		(7.0)
NET TOTAL BLACK SEA		158.4		79.2		11.0		248.6
EX BALTIC SEA								
To Bloc								
North Europe	-	-	2.3	2.5	-	-	2.3	2.5
To Free World								
North Europe	2.9	4.9	8.8	13.2	0.3	0.3	12.0	18.4
Western & Central Europe	-	-	1.0	2.0	-	-	1.0	2.0
TOTAL BALTIC	2.9	4.9	12.1	17.7	0.3	0.3	15.3	22.9
EX SAKHALIN								
To Free World								
Far East	1.0	2.4	-	-	-	-	1.0	2.4
GRAND TOTAL	26.5	165.7	23.0	96.9	2.5	11.3	52.0	273.9

ESTIMATED SOVIET BLOC TANKER SCRAPPINGS PRIOR TO JANUARY 1, 1965

VESSEL NAME	YEAR BUILT	T-2 EQUIVALENT
Agamali Ogli	1930	.37
Moskva	1931	.37
	Total	.74

The above availability considers only new orders already placed for new construction, without attempting to forecast new orders for delivery in 1964 and 1965.

c. Assumed New Construction

Due to an apparent shortage during 1965, it is believed that the Soviets will place orders for additional tonnage in the Free World and in the USSR for 1964 and 1965 delivery. At least six 47,000 dwt tankers could probably be built in Japan, Italy, Yugoslavia, and/or the USSR. This would be equivalent to around 19.3 T-2's. It is believed that the USSR will not procure many tankers in excess of the 47,000 dwt size due mainly to port restriction.

d. Customer Arranged Transportation

The deficit between requirements and availability will probably be covered in part through f.o.b. sales or customer arranged transportation agreements. Platt's Oilgram of April 20, 1962, carried the following news note:

> "Half of Japan's Russian Oil imports this year will be carried by Japanese ships. This was agreed to by P.L. Abroskin, head of a Soviet industrial inspection mission currently visiting Japan, etc."

If this agreement can be extended through 1965, approximately 32.8 T-2 equivalents of the uncovered requirements would be carried in Japanese bottoms.

In addition, there is one vessel now building in Finland to be operated by Neste O/Y which is being built especially for USSR/Finland trade. This tanker is equivalent to the USSR/ Finland requirement of 2.0 T-2's.

e. Bloc Tonnage Balance - Average 1965

		T-2 EQUIVALENT
Average Requirements		273.9
Known Bloc Availability	201.8	
Assumed New Orders	19.3	
Total Bloc Availability	221.1	
Known Yugoslavian Availability	8.4	
Customer Arranged	34.8	
Apparent Deficit *	9.6	
Total Free World	52.8	
Total Availability		273.9

* Assumed supplied by Free World Charter.

The Committee believes that the apparent deficit is so small that for all intents and purposes, the Soviet Bloc will have sufficient owned tankers to transport an export volume of 1,040,000 b/d in 1965 except for a small amount of transportation their customers will provide. The Soviet Bloc fleet (as estimated for 1965) will have 84 percent coverage in owned plus Yugoslav tonnage. It is of importance to note that they reached this only through a tremendous building expansion of the fleet. In this expansion the Free World yards contributed twice the tonnage that the Bloc yards built.

8. Emergency Tanker Requirements During Loss of Soviet Bloc Supplies

One measure of the strategic significance of relying on Soviet Bloc oil and transportation facilities can be obtained by estimating the effect on transportation requirements in the event of a political emergency which would cut off the flow of Bloc oil exports and the use of Bloc transportation facilities.

The table below presents an estimate of 1965 transportation requirements to supply replacement for Soviet Bloc oil. The table is based on the assumption that all 1965 crude and products (except those to Cuba) which are shown in Table 18-6 as being supplied to the Free World by the Soviet Bloc will instead be supplied in Free World bottoms from either the Caribbean or the Persian Gulf, depending on which source is closer to the consuming area. This situation would require a total of 283.9 T-2 equivalents, 231.1 T-2's more than will be required from the Free World under the base condition. This amounts to about 5% of the total estimated Free World fleet in that year. Peak season requirements would be even higher. The availability of this number of Free World tankers in the case of a sudden emergency is highly problematical. At the very least, any tankers which might be normally in tie-up could not be available for prompt loadings, but would incur delays of from 30 to 90 days before arriving at loading terminals. In addition, this simplified analysis assumes that there would be readily available 460,000 barrels per day of crude production in the Caribbean, plus 465,000 barrels per day in the Persian Gulf. It is evident that the emergency supply problems would be so critical as to warrant a serious appraisal of the world-wide consequences.

1965 EMERGENCY TANKER REQUIREMENTS
DURING LOSS OF SOVIET BLOC SUPPLIES

	AVERAGE 1965 EQUIVALENT T-2 REQUIREMENTS		
IMPORTING AREA	EX CARIBBEAN	EX PERSIAN GULF	TOTAL
North and West Europe	123.0	-	123.0
Central and South Europe	-	67.1	67.1
Africa and Far East	3.9	77.5	81.4
Western Hemisphere (Ex Cuba)	12.4	-	12.4
	139.3	144.6	283.9
Less: Free World Tonnage returned to Free World Trade			-52.8
Net Additional Free World Tonnage Required			231.1

B. Tanker Fleet Costs

1. Costs of Operation

No information was obtainable on costs of operation of the Soviet fleet. However, an attempt has been made to indicate the fall in costs which will occur between 1961 and 1965 on the assumption that Soviet fleet costs for comparable sized vessels do not differ materially from those in West European fleets. An estimate of operating costs per 1,000 loaded ton miles for different sizes of vessel has been made and the results are shown on Table 18-19 and charted in Figure No. 19. Dividing the Soviet fleet into weight categories and using the derived operating costs, an average fleet cost has been obtained. This fleet cost is forecast to fall from $1.13 to $0.86 per 1,000 loaded ton miles between 1961 and 1965, a decrease of 24 percent. Only tankers of 10,000 dwt and over have been included in this comparison because of the greater uncertainty in estimating the cost of the small ships.

The 1,000 loaded ton miles operating costs include all expenses except port charges, Suez Canal and Dardanelles dues.

2. Costs of Construction of Tankers

No data are available on the construction cost of Soviet-built tankers; however, the figures on tankers ordered from Free World shipyards indicate the Russians are paying a small premium over going market prices. In all cases the prices paid by the Russians for vessels are obscured by the barter arrangements common to USSR bilateral trade agreements. Vessels scheduled for delivery from Japanese yards in 1962 and 1963 will cost $150 per dwt according to one source and $170 according to another. As for the Italian new-buildings, they are paying the equivalent of $140 per dwt for six 48,000 dwt tankers scheduled for delivery in 1963-1965. Since the price that was current when these vessels were ordered in the latter part of 1960 was about $150 per dwt for these ships ($140 dwt for standard design plus $10 for extras), the USSR is apparently paying little or no premium.

Figure No. 19

OPERATING EXPENSES OF TANKERS PER 1,000 LOADED TON-MILES

(Excluding Port Charges)

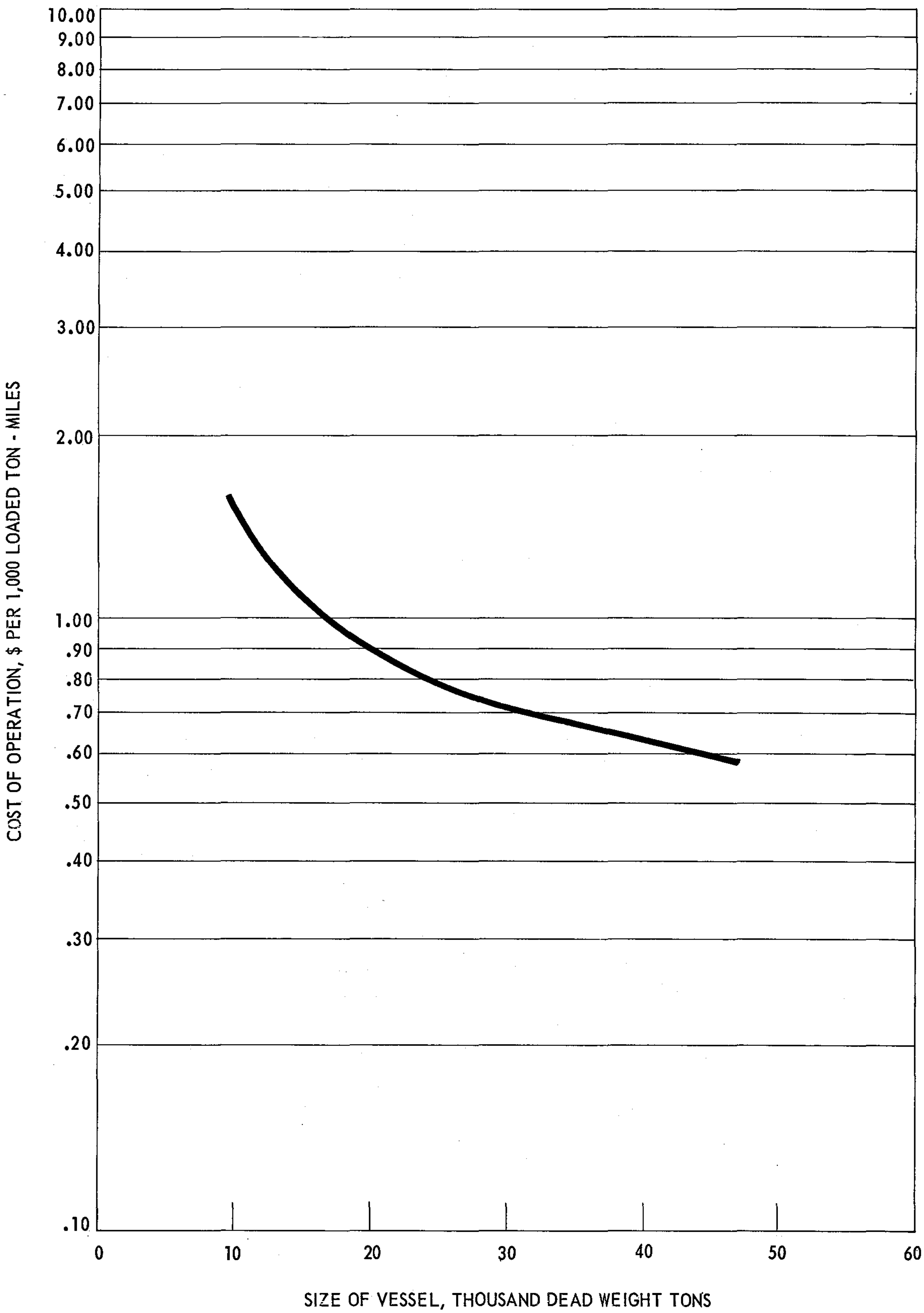


TABLE 18-19

SOVIET BLOC TANKER FLEET
10,000 DWT AND OVER - AVERAGE COSTS

APPROXIMATE COST OF OPERATION PER 1,000 LOADED TON MILES	APPROXIMATE D.W.T. PER VESSEL	1961 D.W.T. IN EACH CATEGORY	1965 D.W.T. IN EACH CATEGORY
$1.60	10,000	39,900	0
$1.30	12,500	756,000	881,300
$1.05	16,000	31,000	62,200
$0.92	19,000	61,600	384,100
$0.79	25,000	75,000	475,000
$0.71	31,000	147,500	237,000
$0.68	35,000	-	666,700
$0.64	40,000	79,100	79,100
$0.59	47,000	-	852,000
		1,190,100	3,637,400

Costs exclude port charges, Suez Canal, and Dardanelles dues.
Average Fleet Cost: 1961 - $1.13 per 1,000 loaded ton miles.
1965 - $0.86 per 1,000 loaded ton miles.

C. Chartering Activity

1. Introduction

Details relating to chartering of tankers from Soviet ports are reported in Lloyds of London weekly list and information from this publication forms the basis for the following discussion on rates and fixtures. All charters reported related to shipments from the Black Sea. It is unlikely that chartered vessels have been used so far on trips out of Baltic ports or from Sakhalin. The data on all reported charters were used; however, there is no obligation on the part of charterers, owners or brokers to report such charters. While fixtures in any one of the large chartering centers, e.g. London, are normally reported, there are some charters fixed directly between owners and charterers outside these main centers on which the rate details sometimes escape being reported. In all instances, however, actual tonnage employed in Communist Bloc trading to the Free World is known, and comparison of actual tonnage employed in Bloc-Free World trading with the fixtures reported disclose no significant void in the information from which our conclusions are drawn. It should be noted that this analysis excludes tonnage employed in these trades where the purchaser of petroleum, buying on an f.o.b. basis, has his own tanker fleet in which to lift his purchases. So far as is known, the USSR prefers to sell c.i.f. rather than f.o.b., but there have been instances where f.o.b. sales were made with the buyers transporting in controlled ships. This is the case on sales to Brazil where the Brazilian authorities are anxious to insure that Brazil's imports are carried to the maximum extent in Brazilian controlled vessels.

2. Types of Charters

The Soviet Union has employed three types of fixtures for chartered tonnage on movements from the Black Sea:

(a) Single voyage charter of specific vessels at a given cost per ton of oil;

(b) Period or time charter of specific vessels at a given rate per ton of carrying capacity of the vessel;

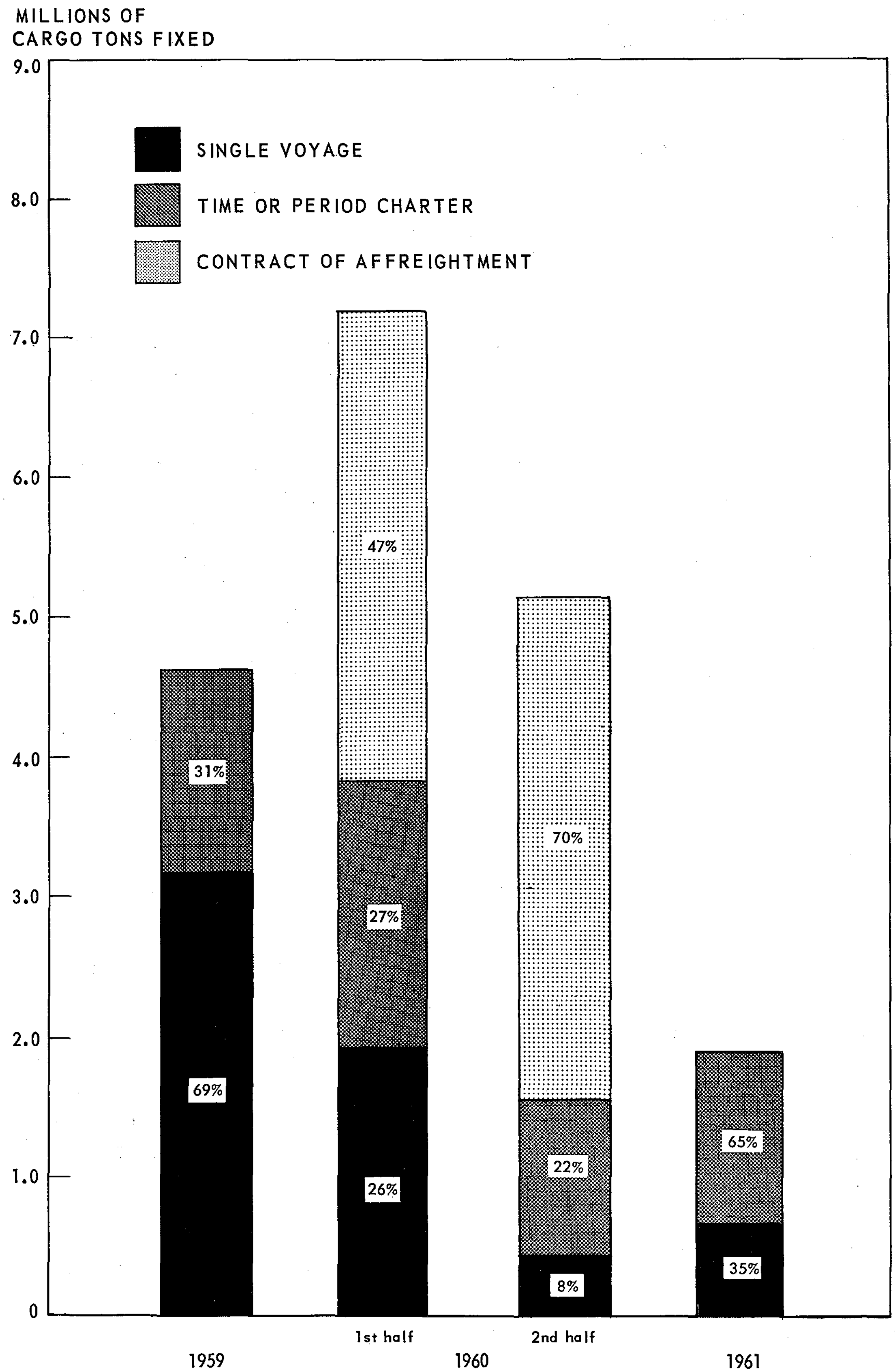
(c) Contracts of affreightment to move a specific tonnage at a given cost per ton of oil.

3. History of Charters

The USSR engaged in little activity in the Free World charter market before 1958. Chartered tonnage employed subsequent to 1958 is summarized below by type of fixture and is shown graphically in Figure No. 20.

Figure No. 20

BLACK SEA TANKER CHARTERING ACTIVITY



KNOWN USSR CHARTERS OF FREE WORLD SHIPS
BY TYPE OF CHARTER, 1959-61
(THOUSANDS OF CARGO TONS)

TYPE OF CHARTER	1959	1960	1961
Single Voyage Charters	3,190	2,300	650
Period Charters	1,430	3,050	1,240
Contracts of Affreightment	-	6,960(min.)	-

During 1959, the Russians fixed about two-thirds of their chartered tonnage in the single voyage spot market and about one-third in the period or time charter market.

During 1960, the Soviet Union undertook to supply all the oil requirements of Cuba in addition to its other export markets. As a result of this political decision, both time or period charters and contracts of affreightment were greatly augmented in order to insure continuity of shipping on the long haul from Black Sea ports to Cuba. During the first half of 1960, 5,300,000 cargo tons of time or period charters and contracts of affreightment were fixed, and an additional 4,710,000 cargo tons (minimum) of these types of charter were fixed during the last half of 1960. This amount fixed during the last six months of 1960 is stated as a minimum because the exact amount covered by one contract of affreightment is unknown and movements against the contract are continuing.

In 1961, only a small number of spot and time charters were placed by the Soviet Union because they were apparently able to satisfy their ocean freight movement requirements through the large placement of time charters and contracts of affreightment in 1960 and with their new buildings.

The USSR has five main contracts with Free World owners. Following is a summary of the information available on these principal contracts by nationality of owners.

a. British

Three and one-half million tons of Soviet oil has been transported between August, 1960, and February, 1962, under this contract. It is understood that the contract continues into 1964.

b. Greek

One owner transported 1,200,000 tons to Scandinavia and Italy, and is now fulfilling a contract of 800,000 tons to Japan. In addition to this, he had delivered 750,000 tons of Soviet crude to the Hellenic Petroleum Refining Company at Aspropyrgos in Greece.

Another owner of Greek nationality contracted during the last half of 1960 to transport an unknown tonnage of oil to a number of destinations at a rate 20 percent above the monthly London Panel Award Rate, but with a minimum rate set at Scale No. 3 minus (-) 20 percent, and a maximum rate of Scale No. 3 plus (+) 50 percent. Through 1961, this owner had lifted 3,580,000 tons to Greece, Cuba, Italy, other European nations, Japan, Iceland, Egypt and Brazil. Of this total volume moved, 2,660,000 tons had moved to Cuba under this contract.

c. Norwegian

A Norwegian owner contracted to lift 100,000 tons per year for three years from about April, 1960 and has so far lifted about 180,000 tons. (Originally reported in list of charters as contract for 200,000 tons in all.)

Another Norwegian owner has contracted to lift 380,000 tons over three years from September, 1960, from Black Sea to Japan. He has so far lifted about 210,000 tons.

4. <u>Cost of Charters</u>

The following data have been developed in order to estimate the cost paid by the USSR relative to rates paid by Free World charterers and to determine the impact, if any of the policy of a major oil company not to charter from owners of vessels who had contracted with the Bloc for movements of petroleum anywhere to the Free World after July 1, 1960 (hereafter referred to as "Black Sea" Policy).

a. Single Voyage Charters

Black Sea single voyage charters were reviewed and modified where necessary to make the rate information comparable with Free World industry charter rate data on the date of fixture. Tanker rates paid by Free World charterers for soft currency dirty fixtures have been based on daily quotations for similar tonnage by New York tanker brokers.

The following table indicates the extent to which rate information on USSR single voyage charters is available for analysis. From this, it will be noted that 163 of the 176 dirty fixtures reported in Lloyds for the period 1959-61 and 108 of the 118 clean fixtures reported are tabulated and available for analysis.

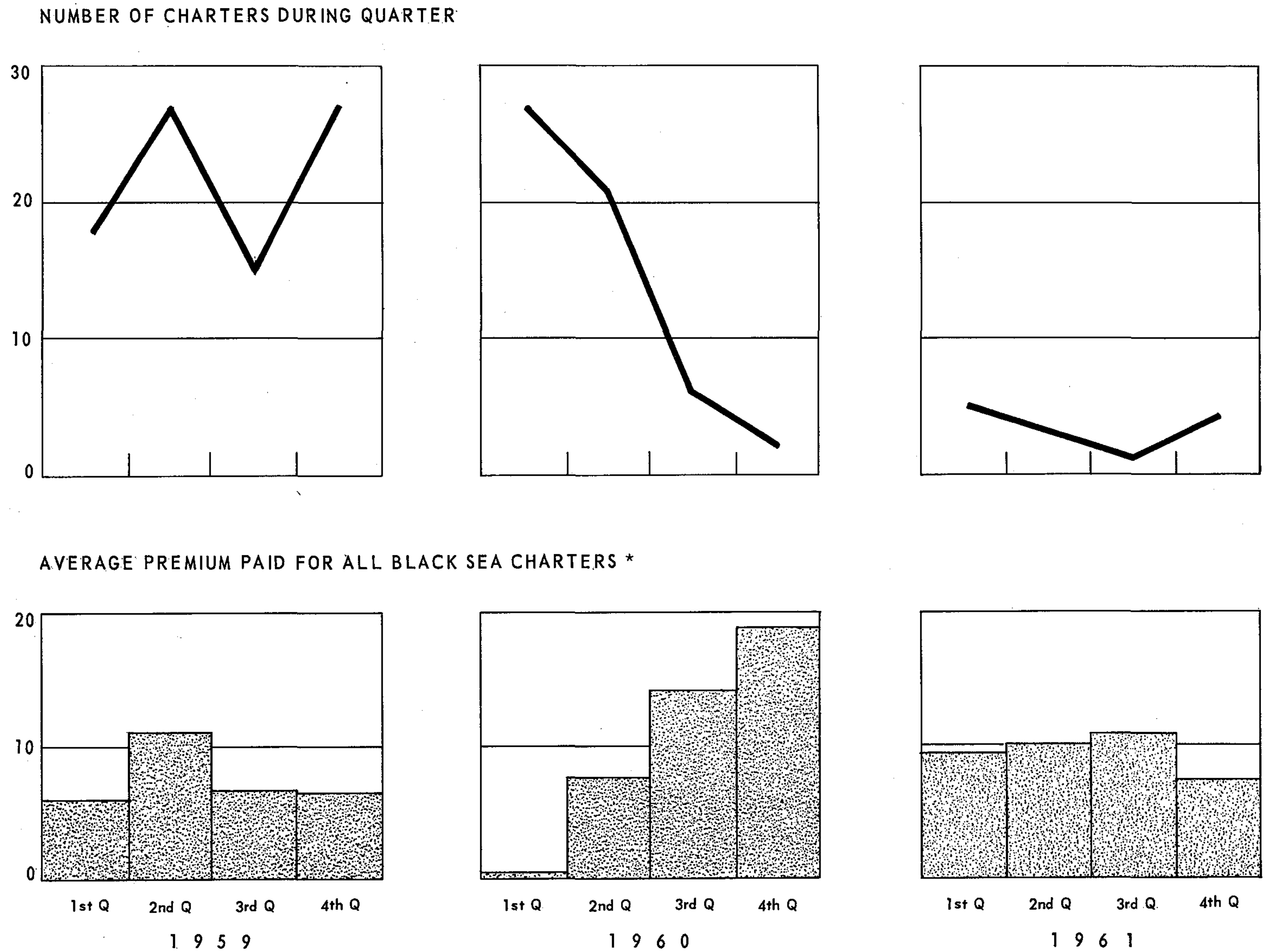
	FIXTURES REPORTED		FIXTURES WITH RATE DATA AVAILABLE	
	CLEAN	DIRTY	CLEAN	DIRTY
1959	72	100	65	96
1960	40	67	37	56
1961	6	14	6	11
TOTAL	118	181	108	163

USSR activity in the single voyage charter market and the premiums paid for Black Sea charters over Free World tanker market rates are shown in Figure No. 21 for the period 1959 through 1961. This clearly indicates the reduced activity in the spot tanker market starting about the second quarter of 1960 as they shifted to longer term contracts to fulfill their export tonnage requirements. (It was in February, 1960, that the USSR agreed to undertake the supply of Cuba's complete oil requirements.) This chart also indicates that owners were reducing the premium required to operate their vessels in Black Sea trading until the second quarter of 1960. Single voyage charter rates in the Free World began to rise sharply in the third quarter of 1960 and the premium paid by the USSR for its fixtures also increased. Beginning in the first quarter 1961, the premium declined.

With all the various factors that could effect chartering activity and the premium that Free World owners would demand from the Bloc, it is of course impossible to attribute the fluctuations in premium to a single cause. Nevertheless it is of interest to observe the change in premium for the 18 months preceeding the adoption of the "Black Sea" Policy on July 1, 1960 with the premium for the 18 succeeding months.

Figure No. 21

SINGLE VOYAGE FIXTURES FROM THE BLACK SEA



* EXPRESSED AS POINTS OF " SCALE "

This was done by comparing each fixture to the Bloc with the prevailing rate as quoted by New York tanker brokers for that day. This comparison is summarized below:

PREMIUM RATES PAID BY USSR FOR SINGLE VOYAGE CHARTERS OVER FREE WORLD RATES AT DATE OF FIXTURE (POINTS OF SCALE NUMBER 3)

	JANUARY 1959/ JUNE 1960		JULY 1960/ DECEMBER 1961		ADDED PREMIUM DURING JULY 1960/DECEMBER 1961 OVER JANUARY 1959/ JUNE 1960
	PREMIUM SCALE POINTS	NUMBER OF FIXTURES USED	PREMIUM SCALE POINTS	NUMBER OF FIXTURES USED	
Continent-Clean	0.9	87	7.6	6	6.7
Continent-Dirty	9.4	124	20.4	17	11.0
Japan-Dirty	4.0	12	8.0	5	4.0
Western Hemisphere-Dirty	9.6	13	13.1	2	3.5

b. Period Charters and Contracts of Affreightment

During 1959, the USSR was relying on longer term contract tonnage for 31 percent of their ocean tanker requirements (Figure No. 20). During the first half of 1960, however, longer term contract tonnage represented 74 percent of the total tonnage fixtures and this proportion increased to about 87 percent of the total tonnage fixed in the post July 1960 period through 1961, though fixtures of any sort were extremely low during 1961. This increasing reliance on longer term fixtures undoubtedly reflects fundamental changes in Soviet chartering policy emanating, perhaps, from the transportation pressures of the Cuban oil supply agreement, the demand of Free World owners for greater guarantee of long-term employment for their vessels and the tightening condition of the Free World Tanker market during the latter half of 1960.

Premium rates paid by the Soviet for period chartered and contract of affreightment tonnage after July 1960, have been determined on the basis of time charter fixtures reported in Lloyds list and comparable Free World rates derived on the basis of weekly assessments of the one year consecutive voyage charter rate for a 16/18,000 dwt dirty vessel in the Caribbean to North Europe trade prepared by a London tanker broker, H. Clarkson and Company, Ltd. The USSR fixtures were compared with the Clarkson list by determining the daily hire the owner was obtaining and then converting the hire to a Scale No. 3 equivalent for the Caribbean/North Europe trade after adjustment for differences in vessel size and clean or dirty trading. The USSR contracts of affreightment were compared in the same manner to the Clarkson period charter list.

These comparisons are shown in Tables 18-20 and Table 18-21.

PREMIUM RATES PAID BY USSR FOR PERIOD CHARTERS AND CONTRACTS OF AFFREIGHTMENT OVER FREE WORLD PERIOD RATES AT DATE OF FIXTURE (POINTS OF SCALE NUMBER 3)

PERIOD CHARTERS	JANUARY 1959/ JUNE 1960	JULY 1960/ DECEMBER 1961
Continent-Clean	None	5.0
Continent-Dirty	None	15.2
Japan-Dirty	None	-
CONTRACTS OF AFFREIGHTMENT		
Continent-Clean	None	28
Japan-Dirty	None	29
Cuba-Dirty	No Fixtures	28
Miscellaneous	No Fixtures	28

While the USSR may have had an incentive to place increasing reliance on assured tonnage because of transportation pressures or the outlook for spot tankers in late 1960, such reasons would not necessarily offer an explanation for any change in premiums paid for period charter of Free World tonnage. However, examination of the rates paid by the USSR for period or contract of affreightment tonnage discloses that it was only after the second quarter of 1960 that Free World owners were able to extract premium rates for Black Sea trading over those rates prevailing in Free World markets.

D. Impact of "Black Sea" Policy on USSR Tonnage Costs

Comparison of charter costs incurred by the Soviet Union for all types of tonnage fixed with costs incurred by

TABLE 18-20

COMPARISON OF USSR PERIOD CHARTER
RATES AND FREE WORLD CHARTER RATES AT DATE OF FIXTURE

	PERIOD CHARTERS				RATE, SCALE #3 MINUS		PREMIUM RATES PAID BY USSR b/	
	DATE	VESSEL SIZE (THOUSAND D.W.T.)*	THOUSAND CARGO TONS	DESTINATION	PAID BY USSR	FREE WORLD RATES FOR SIMILAR TONNAGES a/	POINTS OF SCALE #3	$US/TON
1959	Feb. 14	8.5 c	85.0	Mediterranean	+ 10.0	+ 10.0	-	-
	March 7	18.0 d	276.5	Mediterranean	32.5	25.0	-	-
	June 3	15.0 d	77.2	Continent/Scandinavian	37.5	35.0	-	-
	June 3	18.0 d	102.1	Continent/Scandinavian	42.5	37.5	-	-
	June 3	18.0 d	101.4	Continent/Scandinavian	42.5	37.5	-	-
	June 11	16.0 d	65.6	Hamburg	35.0	35.0	-	-
	June 11	14.0 d	68.0	Hamburg	35.0	35.0	-	-
	Nov. 2	16.4 d	155.1	Mediterranean/Continent	42.5	42.5	-	-
	Nov. 3	12.5 d	52.6	Mediterranean/Continent	25.0	25.0	-	-
	Nov. 11	15.6 d	131.5	Mediterranean/Continent	35.0	35.0	-	-
	Nov. 13	17.0 d	102.1	Continent/Scandinavian	42.5	40.0	-	-
	Nov. 14	17.9 d	91.5	Mediterranean/Continent	45.0	45.0	-	-
	Nov. 16	13.6 c	66.3	Hamburg	25.0	25.0	-	-
	Dec. 8	12.5 d	52.6	Mediterranean/Continent	28.0	25.0	-	-
Totals, 1959			1,427.5				-	-
1960	Feb. 13	20.0 d	82.7	Japan	50.0	45.0	-	-
	Feb. 26	15.0 c	166.4	United Arab Republic	26.0	26.0	-	-
	March 5	16.0 d	89.2	United Kingdom/Continent	50.0	45.0	-	-
	March 23	13.0 c	69.1	Continent/Scandinavian	30.0	30.0	-	-
	May 17	17.5 d	126.6	Continent	47.5	45.0	-	-
	May 17	17.0 d	119.1	Continent	47.5	45.0	-	-
	June 8	18.5 d	225.0	Japan	51.0	45.0	-	-
	June 15	26.8 d	1,043.7	Continent/Scandinavian	47.5	45.0	-	-
Sub-Totals - 1st Half, 1960			1,921.8				-	-
	Aug. 13	19.0 d	211.4	Continent/Scandinavian	30.0	45.0	15.0	.671
	Aug. 17	25.0 d	271.7	Continent	30.0	50.0	20.0	.896
	Oct. 11	16.5 d	293.4	Italy	17.5	30.0	12.5	.334
	Nov. 24	18.0 c	351.0	Mediterranean	17.5	22.5	5.0	.134
Sub-Totals - 2nd Half, 1960			1,127.5				12.4	.470
1961	Jan. 7	16.0 d	240.2	Mediterranean/Continent	22.5	40.0	17.5	.782
	Jan. 11	15.0 d	294.3	Mediterranean/Continent	22.5	35.0	12.5	.560
	Feb. 8	12.2 c	90.1	Continent/Scandinavian	22.5	27.5	5.0	.224
	May 16	40.0 d	325.3	Japan	60.0	60.0	-	-
	May 18	14.0 d	35.3	Japan	45.0	45.0	-	-
	Dec. 29	12.5 d	253.2	Continent/Scandinavian	20.0	35.0	15.0	.671
Totals			1,238.4				9.8	.438
Totals (July 1960-Dec. 1961)			2,365.9				11.0	.451

* c = Clean; d = Dirty.
a/ Free World rates derived on basis of weekly assessment of one year charter rate for 16/18,000 DWT dirty vessel in Caribbean to North Europe trade.
b/ Prior to July 1960, Soviet charters were often below assessment of Free World market rate and were therefore setting Free World rates. However, after July 1960, charter rates paid by the USSR were always higher than the Free World market assessment except in the Black Sea to Japan trade.

TABLE 18-21

COMPARISON OF USSR CONTRACT
OF AFFREIGHTMENT RATES AND
COMPARABLE FREE WORLD RATES

		MOVEMENTS UNDER CONTRACT, JULY 1960 TO DECEMBER 1961		RATE, SCALE #3 MINUS		PREMIUM PAID BY USSR	
DATE OF CONTRACT	OWNER'S NATIONALITY	THOUSAND CARGO TONS	DESTINATION	PAID BY USSR	FREE WORLD RATE	POINTS OF SCALE #3	$US/TON
March 12, 1960	Norwegian	178.0	Japan	43.5	40	-	-
June 1, 1960	Norwegian	208.0	Japan-Scandinavia	50.0	48	-	-
June 21, 1960	Greek	1221.0	Italy	45.5	45	-	-
June 23/24, 1960	Greek	854.0	Japan	52.0	49	-	-
June 23, 1960	Greek	707.0	Greece	45.5	45	-	-
August, 1960	British	3100.0 About	All Destinations	Not Known	48	Not Known	-
August, 1960	Greek	17.0	Greece	20.0*	48	28	.50
		100.0	Italy	20.0*	48	28	.75
		225.6	Continent	20.0*	48	28	1.25
		83.7	United Arab Republic	20.0*	48	28	.61
		14.5	Iceland	20.0*	48	28	1.42
		2664.6	Cuba	20.0*	48	28	1.95
		124.4	Brazil	20.0*	48	28	2.00
		346.0	Japan	20.0*	49	29	2.84
TOTAL OF KNOWN PREMIUMS PAID		3575.8				28	1.92

* Minimum Contract rate.

Free World charterers for similar types of tonnage during periods before and after initiation of the "Black Sea" policy serves as a basis for evaluating the overall impact of the policy on the USSR tonnage costs. Periods chosen for the comparison were eighteen months before and after initiation of the policy--January 1959 through June 1960, and July 1960 through 1961. The increase in costs which probably was due to the policy on trading from the Black Sea is derived in the following table:

ADDED COST OF TONNAGE FIXED BY USSR
AFTER INSTITUTION OF THE BLACK SEA POLICY

TYPE OF FIXTURE	TRADE	1000 CARGO TONS FIXED JULY 1960 DECEMBER 1961	ADDED COST OF TONNAGE FIXED: ADDED PREMIUM (JULY 1960 TO DEC. 1961 OVER JAN. 1959 TO JUNE 1960) SCALE POINTS	DOLLAR PER CARGO TON	$ 1,000
Single Voyage	Continent-Clean	344	+ 6.7	.30	103
	Continent-Dirty	432	+ 11.0	.49	212
	Japan-Dirty	270	+ 4.0	.39	106
	Western Hemisphere-Dirty	30	+ 3.4	.24	7
	Total	1,076			428
Period Charters	Continent-Clean	441	+ 5.0	.15	67
	Continent-Dirty	1,564	+ 15.2	.64	1,005
	Japan-Dirty	361	-	-	-
	Total	2,366			1,072
Contracts of Affreight-ment	Continent (all destinations)	426	+ 28.0	.98	418
	Japan	346	+ 29.0	2.84	985
	Cuba	2,665	+ 28.0	1.95	5,205
	Miscellaneous (Brazil and Iceland)	139	+ 28.0	1.85	257
	Total	3,576			6,865
	GRAND TOTAL	7,018		1.19	8,365

As previously mentioned, there are undoubtedly many factors affecting the premium the USSR pays for tonnage so the effect of the "Black Sea" Policy can not be exactly determined; however, it does seem there was a significant increase in the premium after the adoption of the "Black Sea" Policy. A correlative effect is, of course, that those owners willing to employ their vessels in Soviet trade have enjoyed added revenue. It should be emphasized, however, that this policy on the part of only one oil company has not prevented the Soviet Union from obtaining the tonnage required to serve its markets.

E. Soviet and Satellites Exporting Terminals

1. Conditions at Ports

There is little information available concerning specific details of the individual ports within the Communist area. However, broad guides as to capacity and performance of the main ports are available. These data have been collected from various sources including ship-brokers and oil companies' transportation groups. The following table summarizes the salient factors concerning the major ports and terminals:

MAJOR SOVIET BLOC EXPORTING TERMINALS

PORT	ESTIMATED EXPORTS (Thousand Metric Tons) 1960	1961	LARGEST KNOWN VESSEL FULLY LOADED (DWT)
Novorossiysk	9,267	11,130	37,000
Odessa	4,534	6,389	32,000
Tuapse	3,854	4,436	45,000
Batumi	2,267	2,540	24,500
Constanta	2,720	3,375	19,000
Klaipeda	750	1,100	12,000
Moskalvo	250	900	18,500

2. Black Sea Ports - USSR

a. Odessa

The port of Odessa exports both crude oil and products. The origin of the crude is not clear, as from its position Odessa would not seem to be an ideal export point for Urals-Volga crudes and the only crudes near Odessa, those from the Ukrainian fields, are not as far as is known available for export. There is a product pipeline from the Ploesti fields in Rumania which runs to Odessa and it is possible that Rumanian products are re-exported from Odessa.

As regards the capacity to handle large tankers, it is known that the Praga and the Varshava of approximately 32,000 and 31,000 dead weight tons, respectively, have been fully loaded at Odessa. In addition, the tanker Mir of approximately 40,000 dead weight tons has been loaded at Odessa, but it is not possible to confirm that it was fully loaded.

Turn-around time is believed to be fairly quick.

b. Novorossiysk

Novorossiysk is the main Soviet exporting terminal in the Black Sea, especially for crude oil. The crudes exported are mainly brought from the Urals-Volga area although some crude is moved out from the North Caucasus region. The vessels Agip Ravenna and Agip Gela, both of approximately 33,000 dead weight tons, and also the World Inheritance of just over 37,000 dead weight tons have all been fully loaded at Novorossiysk.

Turn-around time is believed to be fairly quick.

c. Tuapse

The port of Tuapse exports both crude oil and products, the crude oils coming from the same sources as those exported from Novorossiysk. The largest vessel known to have been fully loaded at Tuapse is the Hadrian of nearly 45,000 dead weight tons.

Turn-around time at Tuapse is believed to be very slow.

d. Batumi

Batumi exports both crude and products, there being both crude and product pipelines across the Caucasus from Baku to Batumi. Batumi was once the principal export port for Russian oil. The crudes exported from Batumi came from the Baku fields, from across the Caspian in the Kazakhstan fields, from the Emba fields northeast of the Caspian, and from the Urals-Volga fields by way of either the Volga River or the pipeline which connects these fields with the port of Astrakhan. During 1961, it is thought that only products were exported from Batumi, the Russians apparently preferring to retain Baku crudes for their own use. The largest vessel that has recently entered Batumi is the Adler of 24,500 dead weight tons when loaded to capacity.

Turn-around time is believed to be very slow.

3. Black Seas Ports - Rumania

a. Constanta

Constanta is the main Rumanian exporting terminal, and so far as is known only products are exported. The size of vessel operating out of this port appears to be considerably smaller than those operating from the Russian Black Sea ports. The largest vessel that can be confirmed as fully loaded appears to be about 19,000 dead weight tons, although slightly larger vessels up to about 25,000 dead weight tons have been traced as leaving the port.

The four berths at Constanta have an official maximum draft of 28'6"; however, ships with 29'6" draft have been taken.

4. Baltic Sea - USSR

a. Klaipeda

Klaipeda is probably still only at an early stage of its development. The main exports are fuel oil and these are normally made in small tankers. However, there are two of approximately 12,000 dead weight tons, the Yessentuki and the Liepaja, which use the port regularly. If a branch of the east European pipeline is extended to Klaipeda and a refinery built there, as is planned, this may well become one of the principal Russian ports on the Baltic.

b. Ventspils

The port of Ventspils has an outer harbor in which the channel depth is 27'0". In 1959, the inner harbor channel depth was 25'6", and maximum allowable draft was quoted at 23'0", which would limit tanker size to 8,000 to 10,000 dwt. Recently, however, it was reported that the harbor is now satisfactory for up to 12,000 dwt tankers. Movements which have been reported from Ventspils include mainly petroleum products although crude shipments were initiated in October, 1961.

c. Leningrad

Commodities which move through the port of Leningrad include petroleum products, timber, granite and grain. The upper harbor at Leningrad has water depths ranging from 38'0" to 40'0" and accommodates only non-petroleum movements. The lower harbor, in which the petroleum wharf is located, has water depths ranging from 18'0" to 30'0". Water depths at the lower harbor piers range from 14'0" to 31'0". The petroleum wharf has bunkering facilities available which can accommodate two vessels with maximum draft of 30'0", which limits tanker size to about 16,000 to 20,000 dwt. If the crude oil pipeline which is planned comes into operation eventually in Leningrad and the refinery is enlarged, this port might become another potentially large source of crude and product exports.

5. Adriatic Sea - Albania

a. Vlone

Small amounts of crude oil and asphalt are exported by Albania, mostly to the USSR. Until the recent differences with the USSR, a Soviet submarine squadron was stationed at Vlone, and the port is believed to have substantial petroleum storage facilities and equipment to handle oil exports, though the quantities must be comparatively small.

6. Far East - USSR

a. Moskalvo

This port is not often used but some small exports of Sakhalin crude have been made to Japan. The ship most frequently engaged on this trade was the Aurora of 18,500 dead weight tons. Nothing is known about port facilities.

7. Port Costs

Port costs for a 15,000 tonner do not vary much from port to port; they are about $2,800 to $3,080, except for flag of necessity tonnage for which port expenses are about three times as much. The restrictions on the flags of necessity vessels do not apply at the Rumanian port of Constanta.

Tonnages dues vary between $0.33 and $0.40 per net registered ton ($1.22 per N.R.T. for flags of necessity).

The Agency fee standard for 15,000 tonners is $199.80 (one ruble equals $1.11). Tugs carry a fee of $183.15. Car boat expenses and similar fees amount to about $22.20.

Dardanelles and Bosporus dues total about $1,260 both ways.

CHAPTER XIX

FREE WORLD EXPORT TRADE CONTROLS

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FREE WORLD EXPORT TRADE CONTROLS

SECTION 51

UNITED STATES

The basic controls of exports over commodities from the United States are provided by the following Acts of Congress:

Export Control Act of 1949, as amended.

The Mutual Defense Assistance Control Act of 1951, commonly referred to as the Battle Act.

Trading with the Enemy Act of October 6, 1917, as amended.

A. Export Control Act of 1949:

"It is the policy of the United States to use export controls to the extent necessary, (a) to protect the domestic economy from the excessive drain of scarce materials and to reduce the inflationary impact of abnormal foreign demand; (b) to further the foreign policy of the United States and to aid in fulfilling its international responsibilities; and (c) to exercise the necessary vigilance over exports from the standpoint of their significance to the national security." (Section 2, Export Control Act of 1949).

The Department of Commerce is the designated administrator of this act. Controls as administered by this department are basically of two types: "short supply" export controls and "security" export controls. At the present time there are no "short supply" controls in effect.

Security export controls include a total embargo on exports to Communist China, North Korea and North Vietnam, and broad controls to the USSR and other Soviet Bloc countries in order to control direct shipments of United States products to these destinations. Controls to the free world countries cover only a highly selective list of goods, the control of which is necessary to prevent the unauthorized diversion of free world security goods to the Soviet Bloc, and to prevent the frustration of United States controls over shipments to Soviet Bloc destinations.

All commercial exports from the United States and from its Territories and possessions, except to Canada, are prohibited unless the Department of Commerce has either issued a "validated license" or established a "general license" permitting such shipments.

A validated license is a formal document issued to an exporter by the Department. It authorizes the export of commodities within the specific limitations of the document. It is based upon a signed application submitted by the exporter.

A general license is a broad authorization issued by the Department of Commerce which permits the export of some commodities under specified conditions without requiring the filing of an application by the exporter. Neither the filing of an application nor the issuance of a license document is required in connection with any general license. The authority to export in such an instance is given in the Comprehensive Export Schedule, published by the Department of Commerce, which specifies the conditions under which each general license may be used.

The "Positive List of Controlled Commodities" is a list of commodities controlled by the Department of Commerce for either short supply or security reasons. This list is maintained on a current basis, and identifies the commodities which require a validated export license for shipment to stated destinations.

All Positive List commodities, and all non-Positive List goods, except certain specified general license commodities, require validated licenses for shipment to the USSR and other East European destinations (not including Poland and Yugoslavia); to Communist China, North Korea, and other communist-controlled areas in the Far East; and to Hong Kong, Macao and Cuba.

Exports to Poland require validated licenses for all Positive List commodites and for a small number of specified non-Positive List items. Currently, exports to Yugoslavia, for export control licensing purposes, receive the same treatment as is accorded any other free Western European country.

The Department of Commerce, through its Bureau of International Programs, exercises control over all exports from the United States, except for:

(a) Commodities for the official use of or consumption by the Armed Forces of the United States, or exported by the Department of Defense;

(b) Arms, ammunition, implements of War, helium and technical data relating thereto, which are licensed by the Department of State;

(c) Gold and narcotics, which are licensed by the Treasury Department;

(d) Nuclear material, and technical data relating thereto, which are licensed by the Atomic Energy Commission;

(e) Vessels, other than vessels of war, which are licensed by the U.S. Maritime Administration;

(f) Natural gas, which is licensed by the Federal Power Commission.

Exports to Territories and Possessions of the United States are not subject to export control. United States exports to Canada do not require validated export licenses.

B. <u>The Battle Act:</u>

This Act is administered by the Assistant Secretary of State for Economic Affairs. The Act declares it to be the policy of the United States to embargo the shipments of arms, ammunition and implements of war, atomic energy materials, transportation materials of strategic value and items of primary strategic significance used in the production of arms, ammunition and implements of war, to nations threatening U. S. security, including the USSR and nations under its domination.

Under the Title I provisions of the Battle Act, strategic items are divided into Category "A" items covering arms, ammunition, implements of war and atomic energy materials; and Category "B" items consisting of items of strategic value and materials and equipment of primary strategic significance in the production of war materials, such as metalworking machinery, chemical and petroleum equipment, electrical and power generating equipment, transportation equipment, electronics and precision instruments, certain metals, chemicals, some synthetic rubbers, and general industrial equipment, such as rolling mills, compressors, blowers, etc.

The Battle Act requires the termination of all U.S. assistance--military, economic and financial--to countries which knowingly ship Title I, Category "A" materials to the Soviet Bloc.

The export of Title I, Category "B" items, also requires that aid be terminated unless the President directs, under Section 103(b) of the Act, the continuance of aid where unusual circumstances indicate that the cessation of aid would clearly be detrimental to the security of the United States.

Since passage of the Battle Act, there have been 19 presidential determinations to continue U.S. assistance to: Belgium, Denmark, the Federal Republic of Germany, France, Italy, Japan, The Netherlands, Norway, Turkey and the United Kingdom; and 14 classified determinations affecting eight countries. There have been no instances where assistance has ceased pursuant to the Battle Act provisions.

C. <u>Trading With The Enemy Act:</u>

Administration of this Act has been largely delegated to the Treasury Department and they have issued the following regulations:

Foreign Assets Control Regulations (31 CFR 500.101 <u>et. seq.</u>)

Transaction Control Regulations (31 CFR 505.10 <u>et. seq.</u>)

The Foreign Assets Control Regulations prohibit persons subject to the jurisdiction of the United States from engaging, directly or indirectly in any transaction whatsoever in which there is involved an interest of Communist China or North Korea or nationals thereof, without a Treasury license. In the absence of a Treasury license, these Regulations also have the effect of prohibiting such transactions by a foreign subsidiary of a firm in the United States or by any other foreign firms substantially owned or controlled by persons subject to the jurisdiction of the United States, including transactions involving the sale of any merchandise, whether strategic or non-strategic, to Communist China or North Korea, directly or indirectly.

The Transaction Control Regulations prohibit persons within the United States from selling strategic materials (e.g., items on the United States Department of Commerce's Positive List followed by the letter "A", items on the U.S. Atomic Energy List; items on the State Department's Munitions Control List) which are located in a foreign country to any Soviet Bloc nation in the absence of a Treasury license. The countries to which these regulations apply are:

Albania
Bulgaria
China (Communist controlled)
Czechoslovakia
Estonia
Germany (Only those areas under control or administration of the Union of Soviet Socialist Republics or Poland)
Hungary
Latvia
Lithuania
North Korea
Outer Mongolia
Poland and Danzig
Rumania
Tibet
Union of Soviet Socialist Republics
Vietnam (Only those areas under Communist control)

The effect of the Regulations is also to prohibit such transactions by a foreign subsidiary of a firm in the United States, or by a foreign firm substantially owned or controlled by persons normally resident in the United States, without a Treasury license.

The subsidiaries of American firms abroad may not export commodities to the Soviet Bloc countries defined in the previous page if such commodities are:

(a) Controlled internationally through COCOM Agreement, or

(b) Are contained in the Department of Commerce Positive List, and are identified by the letter "A".

The foregoing is true regardless of whether such commodities are of domestic or foreign origin.

Foreign origin commodities not covered by either (a) or (b) above, may be exported by American subsidiaries abroad to such Soviet Bloc countries even though contained on the Department of Commerce Positive List. Of course, the local regulations, if any, of the countries wherein such subsidiary is operating must be satisfied.

D. Commodities and Goods Controlled by Commerce Department Regulations

A summarized version of the Department of Commerce Positive List as of December 31, 1961, is given in Appendix "A". This is, as previously stated, a list of commodities controlled by the Department of Commerce for either short supply or security reasons, and identifies the commodities which require an individual validated export license for shipment to stated destinations. Also, though not shown in this summary, the Official Positive List designates whether the commodity is an "A" item for purposes of the Trading With The Enemy Act. These "A" items also correspond to Category "B" List of the Battle Act. Other sections of this report point out that the Soviet Union is having trouble in producing the proper quality and sufficient numbers of such petroleum equipment as drilling pipe, tool joints, other tubular goods, drilling bits and gas compressors. In addition, difficulty may be encountered in producing soon enough rotary drill rigs should conversion to this type of rig be made. In view of these shortages in the USSR, the present controls that the Department of Commerce has placed on the export of these commodities are of vital concern. A brief summary of the licensing requirements of this type of equipment is given in Table 19-1.

TABLE 19-1

SUMMATION OF LICENSING REQUIREMENTS FOR EQUIPMENT DETERMINED TO BE IN SHORT SUPPLY IN THE USSR

DEPARTMENT OF COMMERCE SCHEDULE NO.	COMMODITY	LICENSE REQUIREMENT
60610	Seamless Standard Steel Pipe, Black	GRO
60616	Welded Standard Steel Pipe, Black	GRO
60621	Seamless Oil Country Pipe, Carbon Steel (Tubing, Casing, Drill Pipe)	GRO
60623	Seamless Oil Country Pipe, Alloy Steel (High Strength Tubing, Casing, Drill Pipe)	GRO
60624	Welded Oil Country Pipe, Carbon Steel	GRO
60626	Welded Oil Country Pipe, Alloy Steel	GRO
60627	Seamless Line Pipe Over 19"	R
60630	Welded Line Pipe Over 19"	R
73091	Rotary Rigs Under 250 H.P.	R
73095	Rotary Rigs Over 250 H.P.	R
73112	Rotary Drill Bits With Diamonds	GRO
73115	Rotary Drill Bits With Tungston Carbide	RO
73119	Rotary Drill Bits N.E.C.	RO
73225	Drill Collars And Tool Joints For Drill Pipe	GRO
73229	Cable Tool Rigs	GRO
73395	Petroleum And Gas Field Production Equipment Except Christmas Trees Under 2000 Lbs.	R
77046	Large Reciprocating Air And Gas Compressors Of Less Than 2000 H.P.	GRO
77046	Reciprocating Air And Gas Compressors Over 2000 H.P. And 300 p.s.i.	R
77073	Centrifugal Air And Gas Compressors	R*
77076	Axial Flow Turboblowers	R*

* Only certain types are R items.

GRO-General license established for shipment to all destinations except Hong Kong, Macao, the Soviet Bloc (except Poland) or Cuba. Exportations to Poland and Danzig permitted for GRO items shown except item 73112.

R-Validated license required for all shipments to Eastern Hemisphere and Cuba.

RO-Validated license required for all shipments to all countries except Canada.

It will be noted that there are no restrictions on shipment to Poland of the Soviet Bloc of drill pipe, drill collars, and tool joints. Large diameter pipe, that is, over 19", rotary rigs, rotary bits with tungsten carbide, and other rotary bits (not otherwise classified) do require validated license for shipment to all of the nations of the Soviet Bloc as does petroleum and gas field production equipment. However, there is no restriction on the export of these items to the Bloc by a European manufacturer licensed by the U. S. patent holder. Also, there is no restriction to the Bloc of these restricted items for a subsidiary of a U. S. corporation since none of the above restricted items are on the COCOM List or are designated "A" on the Department of Commerce Positive List. In summary, it can be stated that the U. S. export controls do require licensing of some of the type of the petroleum equipment that the Soviets may desire. However, it probably is of only limited effectiveness, since the other COCOM countries do not embargo these items at all.

SECTION 52

OTHER INDUSTRIALIZED NATIONS

In January, 1950, a consultative/coordinating committee (CG-COCOM) was established in Paris to form a coordinated trade control program between certain Free World countries relative to the Sino-Soviet Bloc. The membership now consists of fifteen Western nations--all the NATO countries, plus Japan, except Iceland. These are as follows:

United States
Canada
Japan
Belgium
Denmark
France
Federal Republic of Germany
Greece
Italy
Luxembourg
The Netherlands
Norway
Portugal
Turkey
United Kingdom

The organization has no direct relationship to any multilateral military or economic organization. It has no charter, nor is it based on treaty; hence its agreements represent moral obligations only. The COCOM group maintains a list of arms, atomic energy materials, and other strategic materials that are to be embargoed or kept under surveillance. It also has reached agreement on measures to minimize the risk of unauthorized transshipments. It has also worked out principles of guidance for exceptions to embargoes.

The result of COCOM is that all countries participating have a common policy towards trade controls with the USSR.

According to Pisar 1/, the list and the variety of ancillary controls has fluctuated over the years. A revision in 1954 reduced the list considerably from the scope it had in 1950. This revision reoriented the list to concentrate more directly on key materials whose denials would have an impact upon military preparation and to eliminate items that were more related to the general industrial base. Subsequent reviews have continued to reduce the scope of the list. It is understood that this reduction in scope has largely been at the insistence of the European members of COCOM. The U.S., however, does not limit its controls to COCOM lists. The U.S. controls are much broader and more comprehensive, and are directed more at keeping from the Bloc those things that might augment its industrial potential as well as military. The United States embargoes commodities and technology that the other COCOM countries do not.

The British have published a Consolidated List of Goods subject to embargo that is practically identical in scope to the COCOM Embargo list and it is attached in Appendix "B". It will be noted that there are no embargoes on equipment the USSR has sought or might seek in the future to accelerate their petroleum development. Such equipment would be pipe (particularly of large diameter), drilling bits, drill pipe, drill collars, rotary rigs, gas compressors, control instruments, etc. Tanker vessels are embargoed only if they are designed for speeds in excess of 20 knots.

APPENDIX "A"

SUMMARY OF THE DEPARTMENT OF COMMERCE POSITIVE LIST*

AREA OF CONTROL:

R - Validated license required for a shipment to Eastern Hemisphere and Cuba

RO - Validated license required for shipments to all countries except Canada

Schedule B No.	Commodity description	Area of control
	RUBBER AND MANUFACTURES	
20051-20105	Synthetic rubbers [1]	R [2]
20610-20638	Tire casings [1]	RO
20656	Aircraft inner tubes	RO
20840-20932	Silicone rubber insulating tape, molded braided hose, and packing	R
20998	Silicone rubber manufactures, n.e.c.; and microwave absorber material made principally of rubber.	R [2]
	MAN-MADE FIBERS AND MANUFACTURES	
38418-38482	Yarns, monofilaments, staple, tow, and woven fabrics wholly made of polytetrafluoroethylene.	RO
38590, 39990	Polytetrafluoroethylene filter cloth, packing, and other textile and fiber manufactures.	RO
	PAPER, RELATED PRODUCTS AND MANUFACTURES	
48660	Pressure sensitive synthetic tape [1]	RO
	PETROLEUM AND PRODUCTS	
50150	Blending agents [1]	RO
50180	Jet fuels	RO
50400	Aviation engine lubricating oil [1]	R [2]
50410	Lubricating greases [1]	RO
50590	Hydraulic or automatic transmission fluids [1]	RO
	GLASS AND PRODUCTS	
52311	Silicon lens blanks; and lens blanks for infra-red equipment [1]	RO
52311	Quartz crystals, optical quality	RO
	CLAY AND PRODUCTS	
53620-53689	Refractories [1]	RO
	OTHER NONMETALLIC MINERALS AND PRODUCTS (PRECIOUS INCLUDED)	
54091	Synthetic diamond powder	RO
54114-54140	Abrasive products [1]	RO
54730-54809	Carbon or graphite products [1]	RO
57227	Magnesium oxide, and magnesia cement containing 97 percent or more magnesium oxide.	RO
59506-59509	Quartz crystal, natural and synthetic [1]	RO
59645	Lithium-containing minerals	RO
59900	Synthetic industrial diamonds	RO

See footnotes at end of this Appendix A.

* A reproduction of list published in Export Control, Fifty-Eighth Quarterly Report (Fourth Quarter 1961).

Schedule B No.	Commodity description	Area of control
	IRON AND STEELMAKING RAW MATERIALS	
60030–60085	Scrap, except tin plated or terne plated	RO
60095	Rerolling material	RO
	IRON PRODUCTS AND STEEL MILL PRODUCTS, SEMIFINISHED	
60172–60178	Alloy steel ingots, blooms, billets, slabs, and sheet bars [1]	RO
60181	Alloy steel tube rounds [1]	RO
60185	Alloy steel skelp [1]	RO
60187	Alloy steel wire rods [1]	RO
	IRON PRODUCTS AND STEEL MILL PRODUCTS, ROLLED AND FINISHED	
60220–60270	Alloy steel bars [1]	RO
60315–60335	Alloy steel sheets [1]	RO
60355	Electrical (steel) sheets and strip [1]	RO
60365–60390	Steel strip [1]	RO
60627–60680	Steel pipe, tubes, and tubing [1]	RO [2]
60710–60720	Steel plates	RO [2]
60735	Alloy steel structural shapes [1]	RO
60813–60821	Alloy steel wire [1]	RO
	CASTINGS AND FORGINGS	
61050–61055	Castings, alloy steel, rough and semifinished [1]	RO
61065	Forgings, alloy steel, rough and semifinished [1]	RO
	METAL MANUFACTURES	
61857	Steel pipe fittings [1]	R
61869	Alloy steel perforated sheets [1]	RO
61875	Liquefied gas jacketed storage containers [1]	RO
61881	Steel pipe lined with polytetrafluoroethylene or polytrifluorochloroethylene	RO
61932–61936	Liquefied gas jacketed shipping containers [1]	RO
61938–61944	Welding rods and wires [1]	RO
61952–61964	Wire products [1]	RO
61974–61987	Metal powders [1]	RO
61995	Metal foil [1]	RO
61995	Beryllium manufactures	RO
61995	Copper and copper-base alloy perforated plates and sheets	RO
61995	Liquefied gas jacketed storage containers [1]	RO
61995	Microwave absorber material made principally from metal [1]	RO
61995	Permanent magnets [1]	RO
61995	Thermoelectric materials [1]	RO
61995	Zirconium and zirconium alloy manufactures	RO
	FERROALLOYS	
62230–62290	Ferromolybdenum; ferroboron; ferrocolumbium; ferrocolumbium-tantalum; ferrotantalum; and ferrozirconium.[1]	RO
	COPPER ORES, CONCENTRATES, SCRAP, AND SEMIFABRICATED FORMS	
64010	Copper ore, concentrates, matte, and other unrefined copper	RO
64120	Refined copper in crude forms	RO
64130	Copper scrap	RO
64220–64230	Copper pipe, tubing, plates, sheets, and strip	RO
64251	Copper wire and cable, bare	RO
64290	Copper castings and forgings, rough and semifinished	RO
64290	Copper rods and bars	RO
	COPPER-BASE ALLOYS, SCRAP, AND SEMIFABRICATED FORMS	
64400	Copper-base alloy scrap	RO
64410	Copper-base alloy crude forms	RO
64490	Copper-base alloy bars, rods, and other shapes, extruded, rolled, and drawn	RO
64500–64530	Copper-base alloy plates, sheets, strips, pipe, and tubing	RO
64571	Copper-base alloy wire and cable, bare	RO
64793	Copper-base alloy castings and forgings, rough and semifinished	RO

See footnotes at end of this Appendix A.

Schedule B No.	Commodity description	Area of control
	NICKEL ORES, CONCENTRATES, SCRAP, AND SEMIFABRICATED FORMS	
65455	Nickel ore, concentrates, and matte	RO
65462	Nickel residues and dross; and nickel alloy metal scrap [1]	RO
65467	Nickel alloy metal in crude forms, and bars, rods, sheets, plates, and strip [1]	RO
65480	Nickel alloy semifabricated forms, n.e.c.[1]	RO
	OTHER NONFERROUS ORES, CONCENTRATES, SCRAP AND SEMIFABRICATED FORMS (EXCEPT PRECIOUS)	
66407–66411	Beryllium [1]	RO
66429–66431	Cobalt [1]	RO
66433–66437	Columbium or niobium	RO
66445–66447	Magnesium [1]	RO
66449–66465	Molybdenum [1]	RO
66469–66473	Tantalum	RO
66475	Quicksilver or mercury	RO
66479–66483	Titanium	RO
66487	Alloy steel scrap containing 1 percent or more tungsten	RO
66489	Tungsten wire	RO
66510–66520	Zirconium [1]	RO
66530	Lithium ores and lithium ore concentrates	RO
66540	Other nonferrous metals and alloys, in crude form, scrap, and semifabricated forms, n.e.c.[1]	RO [2]
	PRECIOUS METALS AND PLATED WARE, N.E.C.	
69561	Silver-copper brazing alloy	RO
	ELECTRICAL MACHINERY AND APPARATUS	
70010–70087	Generators and turbo generators, 5,000 kw. and over, and parts and accessories [1]	RO [2]
70101–70108	Welding sets specially designed for the manufacture of arms, munitions, or implements of war.	RO
70110–70115	Mobile generator sets, 5,000 kilowatts and over	RO
70362–70379	Electrical quantity and characteristic measuring and testing apparatus, and parts and accessories.[1]	RO
70400–70498	Electric motors and motor controls, and parts and accessories [1]	RO [2]
70659	Single coil tungsten filaments	RO
70660	Power-controlled searchlights designed for military use	RO
70741–70746	Electric industrial heat-treating, melting, and refining furnaces and parts	RO
70748	High energy electric arc heaters, and parts and accessories	RO
70751–70753	Flash discharge type X-ray tubes, and parts and accessories	RO
70764–70797	Radio, television, and communication equipment [1]	RO
70824–70844	Electron tubes and parts [1]	RO
70848–70859	Other electronic-type components [1]	RO
70867	Radar and other electronic detection and navigational apparatus and parts [1]	RO
70871	Carrier current equipment [1]	RO
70879	Electronic amplifiers, and parts [1]	RO
70883	Recorders and reproducers, and parts and accessories [1]	RO
70886	Electronic equipment, n.e.c.[1]	RO
70888	Telegraph apparatus, and parts [1]	RO
70895	Telephone equipment, and parts [1]	RO
70921–70922	Starting, lighting and ignition equipment [1]	RO
70948	Copper bus bars	RO
70972–70995	Wire and cable, insulated [1]	RO
70997	Electrical steel punchings [1]	RO
70999	Miscellaneous electrical apparatus and parts, n.e.c.[1]	RO
	POWER GENERATING MACHINERY, N.E.C.	
71131–71190	Steam turbines designed for turbogenerators 200,000 kilowatts and over	R
71330–71392	Water tube boilers, marine type, and parts [1]	RO
71450–71590	Diesel engines, 50 horsepower and over, and parts [1]	RO
	CONSTRUCTION, EXCAVATING, MINING, OIL FIELD, AND RELATED MACHINERY	
72000–72021	Power excavators and loading machines, and parts, accessories and attachments [1]	R [3]
72205–72210	Scrapers and graders [1]	R [3]
72225	Contractors' off the-road wheel-type tractors [1]	R [3]
72227	Off-the-road haulers [1]	R [3]
72245	Miscellaneous construction and maintenance equipment, and parts, n.e.c.[1]	R [3]
72511–72540	Materials handling equipment [1]	R [3]
73091–73225	Rotary drill rigs, and parts and accessories [1]	R [3]
73395	Petroleum and natural gas field production equipment, and parts [1]	R

See footnotes at end of this Appendix A.

Schedule B No.	Commodity description	Area of control
	METAL-CUTTING MACHINE TOOLS (NONPORTABLE), PARTS AND ACCESSORIES	
74021	Turret lathes [1]	RO
74032	Artillery and ammunition lathes	RO
74039	Lathes, n.e.c.[1]	RO
74045	Automatic vertical boring and turning mills, cycle type	R
74049-74054	Boring machines, n.e.c.[1]	RO
74058	Shell tappers	RO
74075-74079	Milling machines [1]	RO
74086-74112	Gear-making machines [1]	RO
74200-74234	Drilling machines [1]	RO
74260	Armor plate planers	RO
74391-74410	External and internal cylindrical grinding machines [1]	RO
74420	Grinding machines for broaching tools, automatic cycle, automatic sizing	RO
74427	Band sawing and band filing machines [1]	R
74429	Honing machines [1]	RO
74439	Other metal grinding machines, n.e.c.[1]	RO
74440	Multistation machine tools equipped with closed loop electronic circuits	RO
74447	Rifling and rifle-working machines	RO
74450-74455	Other metal-cutting machine tools [1]	RO
74456-74457	Parts and accessories for machine tools [1]	RO [2]
	METAL-FORMING MACHINE TOOLS, N.E.C., PARTS AND ACCESSORIES	
74459-74461	Metalworking presses [1]	RO [2]
74463	Bending and forming machines [1]	RO
74465	Punching and shearing machines [1]	RO
74466	Forging machines and hammers [1]	RO
74468	Parts and accessories for metal-forming machines [1]	RO [2]
	METALWORKING MACHINES, PARTS AND ACCESSORIES, N.E.C.	
74480	Rolling mill machines, and parts [1]	RO [2]
74500-74529	Foundry equipment, and parts [1]	RO
74580-74601	Metalworking machines, n.e.c., and parts and accessories [1]	RO [2]
	OTHER INDUSTRIAL MACHINES AND PARTS	
76491-76605	Refrigeration equipment capable of maintaining temperatures below minus 130° C.	RO
76650-76680	Measuring, recording, and/or controlling instruments, and parts [1]	RO
76693-76696	Testing and measuring machines, and parts [1]	RO
76698	Geophysical and mineral prospecting equipment, and parts [1]	RO
76910-76935	Ball and roller bearings, and parts [1]	RO
77046-77086	Air and gas compressors, and parts [1]	RO [2]
77046	Diffusion vacuum pumps, 12 inches in diameter and larger	RO
77101-77119	Other pumping equipment [1]	RO [2]
77123	Tubular condensers (heat exchanger type) [1]	RO
77125	Heat exchangers, and parts [1]	RO
77450-77465	Pipe valves and parts [1]	RO
77480	Glassmaking, glass forming, and glass finishing machines; optical curve generators; and parts.[1]	RO [2]
77485	Electronic tube manufacturing and assembling machines, and parts	RO
77516	Pipe assemblies specially fabricated for particular machines or equipment	RO
77520-77525	Chemical and pharmaceutical processing and manufacturing machines, n.e.c., and parts.[1]	RO
77567-77570	Carbon black furnaces, combustion type, and parts and accessories	RO
77585	Processing vessels, and parts [1]	RO
77588	Industrial-type separators and collectors, and parts [1]	RO
77596	Power-driven presses [1]	RO
77599	Miscellaneous industrial manufacturing and service-industries machines, and parts.[1]	RO
	OFFICE, ACCOUNTING, AND COMPUTING MACHINES	
77626-77628	Electronic computers, related information processing machines, parts and accessories.[1]	RO

See footnotes at end of this Appendix A.

Schedule B No.	Commodity description	Area of control
	TRACTORS, N.E.C., PARTS AND ACCESSORIES	
78727-78891	Tracklaying tractors, and parts [1]	R [2]
	AUTOMOBILES, TRUCKS, BUSSES, AND TRAILERS, PARTS, ACCESSORIES AND SERVICE EQUIPMENT	
79013-79045	Motor trucks, military, or equipped to maintain temperatures below 130° C., or equipped with liquefied gas containers.[1]	RO
79057-79078	Motor busses, passenger cars, and chassis, military	RO
79113-79114	Special purpose vehicles, military, or equipped with liquefied gas containers [1]	RO
79130-79133	Used vehicles, military, or equipped to maintain temperatures below 130° C., or equipped with liquefied gas containers.[1]	RO
79136-79145	Trailers, military, or equipped to maintain temperatures below 130° C., or equipped with liquefied gas containers.[1]	RO
79148-79277	Parts and accessories for automotive vehicles [1]	RO
	AIRCRAFT, PARTS AND ACCESSORIES	
79337-79355	Military aircraft, models C-46, C-47 and C-54	RO
79361-79379	Civil aircraft	RO
79381-79496	Aircraft parts and accessories [1]	RO
	RAILWAY TRANSPORTATION EQUIPMENT	
79660-79698	Railroad cars equipped to maintain temperatures below 130° C., or equipped with liquefied gas containers.[1]	RO
	COAL-TAR AND OTHER CYCLIC CHEMICAL PRODUCTS	
80257	Diphenylamine	RO
80279	Fluoroalcohol esters of organic carboxylic acids boiling above 500° F.	RO
80279	P-nitro-N-methylaniline	RO
80279	Polyphenyl ethers containing more than three phenyl groups	RO
80698	Miscellaneous finished coal-tar products [1]	RO
	MEDICINAL AND PHARMACEUTICAL PREPARATIONS	
81398	Medicinal chemicals [1]	RO [2]
	CHEMICAL SPECIALTIES	
82085	Weed killers consisting primarily of boron compounds	RO
82520-82610	Synthetic resins in unfinished and semifinished forms, including scrap [1]	RO
82670	Cellulose acetate dielectric film [1]	RO
82740	Teflon paste	RO
82986	Radioisotopes, compounds, and preparations [1]	RO
82992	Reagent chemicals [1]	RO [2]
82996	Synthetic hydraulic fluids [1]	RO
82999	Miscellaneous chemical specialty compounds, n.e.c.[1]	RO [2]
	INDUSTRIAL CHEMICALS	
83285	Organo-fluorine compounds [1]	RO
83299	Miscellaneous organic chemicals [1]	RO
83440-83460	Lithium bromide; and lithium iodide	RO
83622	Boric acid and borates, except sodium perborate	RO
83799	Sodium azide	RO
83850	Guanidine nitrate; and tetrazene	RO
83959	Chlorine trifluoride	RO
83973	Hydrogen peroxide or dioxide [1]	RO
83979	Metal salts of organic compounds [1]	RO
83990	Other industrial chemicals [1]	RO

See footnotes at end of this Appendix A.

Schedule B No.	Commodity description	Area of control
	PIGMENTS, PAINTS, VARNISHES, AND RELATED MATERIALS	
84290	Cobalt oxide pigments	RO
84380	Polytetrafluoroethylene finishes and enamels; and polytrifluorochloroethylene dispersion.	RO
	EXPLOSIVES, BLASTING AGENTS, FUSES, AND BLASTING CAPS	
86070	Miscellaneous explosives [1]	RO [2]
	PHOTOGRAPHIC AND PROJECTION GOODS	
90028–90230	Cameras for use in space vehicles, and high-speed cameras; parts and accessories therefor, including lenses; micro-flash equipment; and parts and accessories for military cameras.[1]	RO
	SCIENTIFIC AND PROFESSIONAL INSTRUMENTS, APPARATUS, AND SUPPLIES, N.E.C	
91475	Lenses and prisms for infrared equipment	RO
91495	Ion microscopes, and parts therefor [1]	RO
91599	Surgical and medical apparatus made of polytetrafluoroethylene	RO
91620	Integrators, resolvers, and electro-optical monitoring devices, and parts and accessories.[1]	RO
91620	Parts and accessories for military phototheodolites, stereoscopic plotting equipment, and photo interpretation equipment.	RO
91650	Compasses, gyroscopic equipment, and accelerometers, and parts and accessories.[1]	RO
91910–91966	Electro-optical monitoring devices, and parts and accessories [1]	RO
91972	Nuclear detection and measuring instruments, and parts and accessories [1]	RO
91980	Miscellaneous research laboratory apparatus and equipment, and parts, n.e.c.[1]	RO
	ORDNANCE AND PYROTECHNICS	
94700–94745	Small arms and parts [1]	RO
94814–94825	Ammunition and parts [1]	RO
	MISCELLANEOUS COMMODITIES, N.E.C.	
98159	Manufactures of polytetrafluoroethylene and polytrifluorochloroethylene	RO
99960	Bayonets	RO

[1] All types of this commodity under this schedule B group are not on the Positive List. For detail of items included see Comprehensive Export Schedule issued Apr. 1, 1961, and amendments thereto.

[2] In general, the area of control indicated (either RO or R) is applicable to these commodity classifications. However, certain specific commodities are under the other area of control.

APPENDIX "B"

UNITED KINGDOM

CONSOLIDATED LIST OF GOODS SUBJECT TO EMBARGO FOR SOVIET AND CHINA
(Reproduced, with permission, from the Board of Trade Journal, 11 August 1961, pp. iii-xv)

The embargo list relates to those goods which, for reasons of national security are normally prohibited for export to the following countries: Albania, Bulgaria, China, Czechoslovakia, the Eastern Zone of Germany, Hungary, North Korea, North Vietnam, Poland, Rumania, the Soviet Union and Tibet.

Group A

Munitions List

M.L.1. Small arms and machine guns, as follows:
(a) Rifles, carbines, revolvers, pistols, machine pistols and machine guns;
(b) All specially designed components and parts therefor.
NOTE: The Export licensing Branch will consider applications for licences to export small quantities of small arms such as rifles, shotguns, carbines or pistols designed for sporting or ornamental purposes, and ammunition therefor.

M.L.2. Artillery and projectors, as follows:
(a) Guns, howitzers, cannon, mortars, tank destroyers, rocket launchers, military flame throwers, recoilless rifles;
(b) Military smoke, gas and pyrotechnic projectors;
(c) All specially designed components and parts for the foregoing.

M.L.3. Ammunition, and all specially designed components and parts thereof, for the weapons enumerated under items 1 and 2.
See Note to Item 1 above.

M.L.4. Bombs, torpedoes, rockets and missiles (guided or unguided), as follows:
(a) Bombs, torpedoes, grenades (including smoke grenades), smoke canisters, rockets, mines, missiles, (guided or unguided), depth charges, fire bombs, incendiary bombs; and all specially designed components and parts therefor;
(b) Apparatus and devices specially designed for the handling, control, activation, launching, laying, sweeping, discharging, detonation or detection of items enumerated in sub-item (a); and all specially designed components and parts therefor;
(c) Military fuel thickeners specially formulated for the purpose of producing materials which, when added to petroleum products, provide a gel-type incendiary material for use in bombs, projectiles, flame throwers or other implements of war.

M.L.5. Fire control equipment and range finders, as follows:
(a) Fire control, gun laying, night sighting, missile tracking and guidance equipment;
(b) Range, position and height finders, and spotting instruments specially designed for military purposes;
(c) Aiming devices, electronic, gyroscopic, acoustic and optical, specially designed for military purposes;
(d) Bomb sights, bombing computers, gun sights and periscopes, specially designed for military purposes;
(e) Television sighting units specially designed for military purposes, and inertial platforms;
(f) Components, parts, accessories, and attachments specially designed for the articles enumerated in sub-items (a), (b), (c), (d) and (e) above.

M.L.6. Tanks, and vehicles specially designed for military purposes, as follows:
(a) Tanks and self-propelled guns;
(b) Military type armed or armoured vehicles, and vehicles fitted with mountings for arms;
(c) Armoured railway trains;
(d) Military half tracks;
(e) Military type recovery vehicles;
(f) Gun carriers and tractors specially designed for towing artillery;
(g) Trailers specially designed to carry ammunition;
(h) Amphibious and deep water fording military vehicles;
(i) Military mobile repair shops specially designed to service military equipment;
(j) All other specially designed military vehicles;
(k) Pneumatic tyre casings (*excluding* tractor and farm implement types) of a kind specially constructed to be bullet proof or to run when deflated;
(l) All specially designed components and parts for the foregoing.

M.L.7. Toxicological agents, as follows:
(a) Biological, chemical and radio-active materials adapted for use in war to produce casualties in men or animals, or to damage crops;
(b) Equipment specially designed and intended for the dissemination of the materials described in sub-item (a);
(c) Equipment specially designed and intended for defence against the materials described in sub-item (a), and for their detection and identification;
(d) Components and parts specially designed for the items listed in (b) and (c) above.

M.L.8. Powders, explosives and propellants, as follows:
(a) Powders and liquid or solid propellants for the articles enumerated in Items Nos. 3, 4 and 7;
(b) Military high explosives;
(c) Chemical base high energy solid or liquid fuels specially made for military purposes;
(d) Fuming nitric acid.
NOTE: The Export Licensing Branch will consider applications for licences for the export of propellants and explosives normally used for civilian or industrial purposes or made into cartridges or charges of an exclusively civilian or industrial nature.

M.L.9. Vessels of war, and special naval equipment, as follows:
(a) Combatant vessels or vessels designed for offensive or defensive action (surface or under-water);
(b) (i) Diesel engines of 1,500 horse power and over with rotary speed of 700 revolutions per minute or over, specially designed for submarines;
(ii) Electric motors specially designed for submarines, *i.e.* over 1,000 horse power quick reversing type, liquid cooled and totally enclosed;
(c) Magnetic, pressure, and acoustic underwater detection devices specially designed for military purposes; specialized controls and components thereof;
(d) Submarine and torpedo nets;
(e) Components, parts, accessories and attachments for the foregoing, such as turrets, naval gun mounts, submarine batteries and catapults.

M.L.10. Aircraft and helicopters, of the piloted or pilotless types and aero-engines and aircraft or helicopter equipment, associated equipment and components, specially designed for military purposes as set out below:
(a) Combat aircraft and helicopters and other aircraft and helicopters specially designed for military purposes, including military reconnaissance, assault, military training and logistic support, and all aircraft and helicopters having special structural features such as multiple hatches, special doors, ramps, reinforced floors and the like, for transporting and airdropping troops, military equipment and supplies; aero-engines specially designed or adapted for use with such aircraft and helicopters, with the exception of aero-engines excepted under Item 1460 (b) (Group G); and component parts thereof;
(b) Airborne equipment, including airborne refuelling equipment, specially designed for use with the aircraft and helicopters and the engines of the types of aircraft and helicopters covered by sub-items (a) and component parts thereof;
(c) Pressure refuellers, pressure refuelling equipment, equipment specially designed to facilitate operations in confined areas and ground equipment not elsewhere specified, developed specially for aircraft and helicopters, aircraft and helicopter engines and balloons covered by sub-items (a) and (e);

(d) Pressurized breathing equipment and partial pressure suits for use in aircraft and helicopters; anti-"G" suits; military crash helmets; parachutes used for combat personnel, cargo-dropping, and aircraft deceleration; liquid oxygen converters used for aircraft, helicopters and missiles; catapults and cartridge actuated devices utilized in emergency escape of personnel from aircraft and helicopters;
(e) Non-expansive balloons in excess of 3,000 cubic feet capacity.

M.L.11. Electronic equipment specially designed for military use; and components and parts therefor.

M.L.12. Photographic equipment as follows:
(a) (i) Air reconnaissance cameras and associated equipment designed and used for military purposes;
(ii) Film processing and printing machines designed and used for military purposes;
(b) Other cameras and other devices recording on film specially designed and used for military purposes, and specialized equipment designed to make the recorded information militarily useful;
(c) All specially designed components and parts for the foregoing.

M.L.13. Special armoured equipment as follows:
(a) Armour plate;
(b) Military helmets;
(c) Body armour and flak suits;
(d) Components and parts specially designed for equipment in (c) above.

M.L.14. Specialized military training equipment as follows:
(a) Specialized military training equipment;
(b) Components, parts, attachments and accessories specially designed for such equipment.

M.L.15. Military infra-red equipment and specialized components therefore, not elsewhere specified.

M.L.16. Munitions components and materials, as follows:
(a) Brass and bronze fabrications for primer anvils, fabrications for bullet caps (gilding metal clad steel), cartridge link primer cap, shell rotating band;
(b) Copper rotating bands for shells, and other copper munitions components;
(c) Gilding metal clad steel;
(d) Rough steel forgings, steel and alloy castings for guns and for arms.

M.17. Miscellaneous equipment and materials as follows:
(a) Tear gas and equipment for the dissemination thereof;
(b) Self-contained diving and underwater swimming apparatus as follows:
(i) Closed and semi-closed circuit (rebreathing) apparatus;
(ii) Specially designed components for use in the conversion of open-circuit apparatus to military use;
(iii) Articles exclusively designed for military use with self-contained diving and under-water swimming apparatus;
(c) Bayonets;
(d) Fire arms silencers (mufflers);
(e) Power controlled searchlights and control units therefor, designed for military use.

M.L.18. (a) Specialized machinery, equipment, and gear specially designed for the examination, manufacture, testing and checking of the arms, ammunition, appliances and machines referred to in this Group;
(b) Vibration testing equipment capable of providing a thrust greater than 2,000 lbs. and specialized ancillary equipment therefor.

M.L.19. Climatic conditioning chambers capable of simulating any of the following conditions over the whole range of altitudes from sea level to 75,000 feet above: temperature, pressure, radiation or humidity.

M.L.20. Cryogenic equipment, as follows:
(a) Equipment designed for maintaining an ambient temperature below —130° Centrigrade:
(i) Designed for use in marine, airborne or space applications; *or*
(ii) Ruggedized for mobile ground use; *or*
(iii) Designed to maintain operating temperatures for electrical, magnetic or electronic equipment or components;
(b) Electrical, magnetic or electronic equipment or components specially designed for operation continuously or discontinuously at ambient temperatures below —130° Centrigrade;
(c) Specially designed accessories, sub-assemblies, parts or components for sub-items (a) and (b).

Group B

Atomic Energy List

Substitute the following for the existing items in this group:

A.E.1. Source (fertile) and fissionable materials, including but not limited to the following:
(a) Minerals, raw and treated (including residues and tailings) which contain either uranium or thorium or any combination thereof, exceeding 0.05 per cent. by weight, as follows:
(i) Ores containing uranium including pitchblende;
(ii) Monazite and monazite sands;
(iii) Ores containing thorium including urano-thorianite;
(b) Natural uranium, unwrought or wrought, including alloys and compounds of natural uranium, having an uranium content exceeding 0.05 per cent., excepting medicinals;
(c) Uranium 233, alloys containing uranium 233 and compounds of uranium 233;
(d) Uranium enriched in the isotope 235, alloys containing uranium enriched in the isotope 235, and compounds of uranium enriched in the isotope 235;
(e) Irradiated uranium containing plutonium;
(f) Plutonium, alloys containing plutonium and compounds containing plutonium;
(g) Thorium, unwrought or wrought, and alloys and compounds containing thorium, excluding alloys containing less than 1.5 per cent. of thorium by weight, and except medicinals;
(h) Irradiated thorium containing uranium 233.

NOTE: The Export Licensing Branch will consider applications for licences for the export of individual shipments of up to 100 kilogrammes of contained thorium in compounds or up to 1 kilogramme of thorium metal.

A.E.5. Deuterium and compounds, mixtures and solutions containing deuterium, including heavy water and heavy paraffins, in which the ratio of deuterium atoms to hydrogen atoms exceeds 1 : 5,000 by number.

A.E.6. A.E.7. Material previously covered by these items is now embargoed under Group K, items 1718 and 1723.

A.E.8. Zirconium metal, alloys containing more than 50 per cent. zirconium by weight, and compounds, in which the ratio of hafnium content to zirconium content is less than one part to 500 parts by weight; and manufactures wholly thereof.

A.E.9. Nickel wire containing 95 per cent. or more nickel, 0.10 millimetre or less in diameter.

A.E.10. Woven wire mesh composed of wire containing 95 per cent. or more nickel and containing 60 or more wires per linear centimetre.

A.E.11. Nickel powder with a particle size less than 200 microns.
NOTE: The Export Licensing Branch will consider applications for licences for the export of nickel powder not made by the Carbonyl process.

A.E.12. Beryllium metal and manufactures wholly thereof (excluding beryllium windows for medical X-ray machines); beryl (excluding gem grade) and ores; alloys containing more than 50 per cent. beryllium by weight; oxides and other compounds.

A.E.13. Deleted.

A.E.14. Fluorine.

A.E.15. Chlorine trifluoride.

A.E.17. Fluorinated hydrocarbons, as follows:
Trichlorotrifluoroethane;
Dichlorotetrafluoroethane;
NOTE: The Export Licensing Branch will consider applications for licences for the export of individual shipments of up to 1,100 kilogrammes of each of the above fluorinated hydrocarbons.

A.E.18. Equipment specially designed for the separation of isotopes of uranium and/or lithium.

A.E.20. Personal radiation monitoring dosimeters, other than film dosimeters and dosimeters designed specially for use with medical radiation equipment, capable of measuring:
(a) in one exposure, a dosage between 25 and 800 roentgens; or
(b) dose rates of between 1 to 80 roentgens per hour.

A.E.22. Ion separators, electromagnetic, including mass spectographs and mass spectrometers, with analyzer assemblies capable of handling uranium hexafluoride (UF6) and solid source mass spectrometers or mass spectrographs, of high sensitivity.

A.E.24. Positive ion sources suitable for use in mass spectrographs and mass spectrometers and capable of handling uranium hexafluoride (UF6).

A.E.27. Valves 3 centimetres or greater in diameter with bellows seal, wholly made of or lined with aluminium, nickel, or alloy containing 60 per cent. or more nickel, either manually or automatically operated and with other than metal to metal seats.

A.E.28. Deleted. A limited range of furnaces previously covered by this item is still embargoed under Group E item 1203.

A.E.29. Gas centrifuges capable of the enrichment or separation of isotopes.

NOTE: The Export Licensing Branch will consider applications for licences for the export of gas centrifuges specially designed for industrial use and not suitable for atomic energy production use.

A.E.30. Blowers and compressors (turbo, centrifugal and axial flow types), wholly made of or lined with aluminium, nickel or alloy containing 60 per cent. or more nickel, and having a capacity of 60 cubic feet per minute (1,700 litres per minute) or greater.

A.E.31. Electrolytic cells for the production of fluorine with a production capacity greater than 100 grammes of fluorine per hour.

A.E.33. Heat exchangers suitable for use in gaseous diffusion plants, i.e. heat exchangers made of aluminium, copper, nickel, or alloys containing more than 60 per cent. nickel, or combinations of these metals as clad tubes, designed to operate at sub-atmospheric pressure, with a leak rate of less than 10^{-4} atmospheres per hour under a pressure differential of 1 atmosphere.

A.E.34 Artificial graphite, in the form of blocks or rods from which a cube of 2 ins. side or greater can be cut, and having a boron content of less than, or equal to, 1 part for a million, the total thermal neutron absorption cross section being less than, or equal to, 5 millibars per atom.

A.E.35. Lithium metal, compounds, ores and concentrates.

NOTE: The Export Licensing Branch will consider applications for licences for exports of medical lithium compounds, lithium soaps (including lithium stearate), lithium bromide, lithium cobaltite, lithium zirconate, lithium silicate, lithium iodide, lithium chromate and lithium zirconium silicate. The Export Licensing Branch will also consider applications for licences for exports of other lithium material, containing up to a total of 1 kilogramme of contained lithium, natural or depleted in the 6 isotope, except for single crystals.

A.E.36. Nuclear reactors, i.e. reactors capable of operation so as to maintain a controlled, self-sustaining fission chain reaction, and major components designed or intended for use in a nuclear reactor such as reactor vessels, core support structures, coolant pumps, fuel element handling equipment, heat exchangers and control rod drive mechanism.

A.E.37. Hafnium metal, and alloys and compounds of hafnium containing more than 15 per cent. hafnium by weight.

A.E.38. Calcium containing both less than one hundredth (0.01) per cent. by weight of impurities other than magnesium and less than 10 parts per million of boron.

A.E.39. Tritium and compounds containing tritium in which the ratio of tritium to hydrogen by atoms exceeds one part in 1,000.

NOTE: The only compounds of tritium excluded from embargo by this definition are those chemical compounds where the tritium is chemically equivalent to other hydrogen isotopes. The exclusion does not apply to physical mixtures.

Group C

Metal-Working Machinery

1002. Jig boring and/or grinding machines with tables possessing any traverse (longitudinal, transverse or vertical) exceeding 44 inches.

1016. Grinding heads and spindle assemblies (consisting of spindles and bearings as a minimal assembly) designed or rated for operation at speeds in excess of 120,000 revolutions per minute and machines specially designed for the utilization of such grinding heads.

1070. Forging hammers as follows:
- (a) Counter-blow hammers of rated sizes of 180,825 foot pounds or more;
- (b) Horizontal impact hammers hydraulically actuated, of rated sizes of 10,000 foot pounds or more.

1072. Presses and specialized controls, accessories and parts therefor, as follows:
- (a) Presses actuated by explosives;
- (b) Specially designed or re-designed for the working or forming of metals, alloys or other materials with a melting point exceeding 1,900° Centigrade;
- (c) Mechanical and hydraulic, not elsewhere specified, with total rated pressures of over 5,000 tons;

  NOTE: The Export Licensing Branch, provided they are satisfied that the presses are not specially designed for use in forming aircraft, missile, or space vehicle parts, in powder metallurgy or in ceramics production, will consider applications for licences for exports of:
  - (i) Horizontal extrusion presses having a total rated pressure less than 10,000 tons; and
  - (ii) Vertical presses having a total rated pressure less than 15,000 tons.
- (d) Control equipment, accessories and parts which are specially designed for the above presses.

NOTE: The Export Licensing Branch will consider applications for licences for the export of normal amounts of equipment covered by part (d) above to service presses exported under the Note to part (c) above.

1075. Spin-forming machines, *except* those with a spindle drive motor of less than 50 horse power.

1080. Machines and equipment specially designed for making or measuring gas turbine blades.

1081. Machinery for use in the manufacture of aircraft, as follows:
- (a) Machinery specially designed for the working or forming of aircraft sheet, plate or extrusion;
- (b) Machinery specially designed for the milling of aircraft skin.

1086. Machines specially designed for the manufacture of jet engines, the following:
- (a) Jet engine compressor case boring machines;
- (b) Jet engine compressor or turbine disc turning machines;
- (c) Jet engine rotor grinders.

1088. Gear making and/or finishing machinery, as follows:
- (a) Gear grinding machines, generating type, of 36 ins. work diameter and above;
- (b) Capable of the production of gears of a module finer than 0.5 millimetre (diametral pitch finer than 48).

1091. Electronic controls for machine tools (cutting or forming) in which a closed loop feed back device, acting continuously from the work piece or tool or work piece carrier or tool holder itself, ensures continuity of automatic correction of the information received; and machine tools incorporating such controls.

Group D

Chemical and Petroleum Equipment

1106. Counter current solvent extractors, such as pulsed columns and mixer settlers made of stainless steel, specially designed for extracting radio-active substances.

1110. Gas liquefying equipment, as follows:
- (a) Equipment not elsewhere specified, specially designed for the production of gases in liquid form, capable of operating at pressures of 300 lbs. per square inch or over, and producing 1 ton or more per day of gas in liquid form, except:
  - (i) Plants not capable of producing more than 25 per cent. of their total daily product as extractable gas in liquid form;
  - (ii) Plants specially designed for liquefying chlorine or ammonia;
  - (iii) Stationary equipment for liquefying carbon dioxide;
  - (iv) Equipment for liquefying low molecular weight refinery gases;
- (b) Liquid fluorine producing equipment;
- (c) Equipment for the separation of helium from natural gases.

1112. Equipment for production and/or concentration of deuterium oxide.

1118. Equipment for the production of military explosives, as follows:
- (a) Complete installations;
- (b) Specialized components;
- (c) Nitrators: continuous types.

1125. Plant for the production of titanium and/or zirconium metals (excluding separate plant for the production of titanium tetrachloride or zirconium tetrachloride) as follows:
- (a) Complete installations;
- (b) Specialized components;
- (c) Electric furnaces specially designed for the recovery of titanium or zirconium from scrap.

1129. Ion vacuum pumps (that is, those using the principle of ionization) except those having pumping speeds of less than 800 litres of hydrogen per second at a pressure of 10^{-6} millimetre of mercury or more; and specially fabricated parts and accessories, not elsewhere specified.

1131. Pumps (*except* vacuum pumps) capable of delivering liquids separately or in combination with solids and/or gases and having *any* of the following characteristics:
- (a) Designed to move molten metals by electromagnetic forces;

(b) Specially designed for operation at temperatures below—130° Centigrade;
(c) Having all flow contact surfaces made of any of the following materials:
  (i) 90 per cent. or more tantalum, titanium or zirconium, either separately or combined;
  (ii) 50 per cent. or more cobalt or molybdenum, either separately or combined;
  (iii) Polytetrafluoroethylene; polytrifluorochloroethylene.

1133. Valves, cocks and pressure regulators, not elsewhere specified, as follows:
(a) Specially designed to operate at temperatures below—130° Centigrade;
(b) Having all flow contact surfaces made of any of the following materials:
  (i) 90 per cent. or more tantalum, titanium or zirconium, either separately or combined;
  (ii) 50 per cent. or more cobalt or molybdenum, either separately or combined;
  (iii) Polytetrafluoroethylene; polytrifluorochloroethylene.

See also A.E.27.

1142. Pipe and tubing made of, lined with or covered with polytetrafluoroethylene or polytrifluorochloroethylene.

See also item 1718 and 1723.

1145. Containers, jacketed only, for the storage or transportation of liquefied gases, including mobile units, as follows:
(a) Of 1,893 litres (500 gallons) capacity or over, designed for liquid nitrogen, oxygen, hydrogen, ozone, helium, argon or fluorine, *except*
2-shell containers rated for an average evaporation loss of over 5 per cent. per 24-hour period; such loss is to be calculated as a percentage of the total liquid capacity of the container under ambient temperature conditions of +75° Fahrenheit (+24° Centigrade) or higher and without exposure to direct sunlight;
(b) Of 946 litres (250 gallons) up to 1,893 litres (500 gallons), designed for the handling of liquid fluorine.

Equipment for separation of isotopes. (See A.E.18.)
Ion separators, electromagnetic. (See A.E.22.)
Centrifuges capable of the enrichment or separation of isotopes. (See A.E.29.)
Blowers and compressors. (See A.E.30.)
Electrolytic cells for the production of fluorine. (See A.E.31.)
Heat exchangers and components. (See A.E.33.)

Group E

Electrical and Power-Generating Equipment

1203. Electric vacuum furnaces as follows:
(a) Consumable electrode vacuum arc furnaces, not elsewhere specified, with a capacity in excess of 5 tons;
(b) Skull type vacuum arc furnaces;
(c) Electron beam vacuum furnaces;
(d) Cold crucible vacuum induction furnaces designed to operate at pressures lower than 0.1 millimetres of mercury and at temperatures higher than 1100° Centigrade and specialized parts therefor.

1255. Diesel engines, 50 h.p. and over, whose non-magnetic content exceeds 50 per cent. of their total weight.

1266. Electric power generating mobile units of over 5,000 kW.

Group F

General Industrial Equipment

1305. Metal rolling mills, the following:
(a) Sheet and strip mills as follows:
  (1) Having automatic work roll adjustment controls for tapering or contouring along the length of the sheet or strip;
  (2) More than three-high, not elsewhere specified, (including dual purpose mills which can operate as either two- or four-high) which achieve special lateral and/or longitudinal contour control by one or more of the following means:
    (i) Work rolls having a ratio of roll face length to roll diameter which exceeds either:
      6 : 1 for rolls with roll face length up to and including 30 ins.; or
      5 : 1 for rolls with roll face length exceeding 30 ins.;
    (ii) Work roll contour control achieved by concurrent deforming of back-up rolls, back-up shafts or work rolls;
    (iii) Closed loop electronic gauge controls;
    (iv) Control tensiometers (devices which both measure and automatically maintain appropriate adjustment of the tension applied to the metal being rolled);
    (v) Any other feature achieving special lateral and/or longitudinal contour controls comparable to those achieved by (i) and (iv);
(b) Mills specially designed or re-designed for the rolling of metals and alloys with a melting point exceeding 1900° Centigrade;
(c) Specialized controls, parts and accessories for the above mills.

NOTE 1: The term 'sheet and strip mills' covers mills for the rolling of plate, sheet, strip, foil and any equivalent product.

NOTE 2: The Export Licensing Branch will consider applications for licences for the export of:
(a) Hot mills possessing any of the characteristics covered by sub-paragraphs (i) to (v) if these characteristics do not present an improvement in kind and/or quality on similar devices incorporated into operating mills of the same type and size prior to January 1 of the year three years preceding the year of licensing;
(b) Cold mills possessing any of the characteristics covered by sub-paragraphs (i) to (v) if these charactertistics do not present an improvement in kind and/or quality on similar devices incorporated into any operating cold mill before January 1 of the year three years preceding the year of licensing;
(c) All controls, parts and accessories for the above mills.

The term 'improvement in kind or quality' applies only to technical developments resulting in a material increase in efficacity or reliability to achieve the exceptionally close tolerances in lateral and/or longitudinal contour required for military purposes.

NOTE 3: Sub-paragraph (a) (2) (i) of the definition does not cover:
(a) Mills having multiple work rolls rotating in a planetary form round the back-up rolls;
(b) Mills specially designed for the rolling of aluminium foil.

NOTE 4: The term 'more than three-high' covers any mill in which each work roll is supported by one or more back-up rolls.

1325. Construction equipment built to military specifications, specially designed for airborne transport.

1353. Cable-making machinery specially designed for making multipair electric cable for telecommunications purposes, as follows:
(a) Machinery other than that covered by Item 1354 for applying insulating material to conductors;
(b) Machinery for laying conductors together and/or for applying an insulating, separating, binding or identifying material thereto;
(c) Machinery for laying up conductors, pairs, quads, etc., together to form the complete cable core or part thereof.

1354. Cable-making machinery specially designed for making coaxial cable, as follows:
(a) Machines for applying insulating separators to the inner conductor of air-spaced coaxial electric cables;
(b) Machines for applying metal strip or sheet to form the outer conductor of coaxial electric cables;
(c) Machines for forming, stranding, or assembling coaxial cable, with or without conductors other than coaxial tubes;
(d) Automatic equipment for controlling the diameter or the eccentricity of extruded dielectric on wires and cables.

1355. Electronic valve making machinery as follows:
(a) Machinery, equipment and test gear specially designed for the manufacture of the various types of embargoed electronic valves, transistors and crystal diodes (including components or sub-assemblies therefor);
(b) Machinery, equipment and test gear specially designed for the automatic or semi-automatic assembly of electronic valves, transistors and crystal diodes (including components and sub-assemblies therefor).

1360. Equipment for the manufacture of semi-conductor materials as follows:
(a) Equipment specially designed for the production or processing of dendritic forms of any semi-conductor material, or combination thereof, suitable for use in diodes or transistors;
(b) Equipment not elsewhere specified, specially designed for purifying and processing silicon or germanium *except* equipment designed for the zone purification of germanium.

NOTE: The term 'dendritic' signifies a ribbon-like product of semi-conductor material which may be drawn in various widths, thicknesses and lengths and which may represent processing stages from a relatively pure form of the material through advanced stages of treatment.

1380. Centrifugal and axial flow compressors or blowers, not elsewhere specified, capable of an overall compression ratio of 2 : 1 or more coupled with a capacity of over 372,000 cubic feet per minute or of an overall compression ratio of 3 : 1 or more coupled with a capacity of over 106,000 cubic feet per minute.
See also A.E.30.

Group G

Transportation Equipment

1405. Ice breakers of 10,000 shaft horsepower and over.

1410. Tankers designed for speeds of more than 18 knots when in full load (design) condition.

1415. Warships (whether or not converted to non-military use and regardless of current state of repair or operating condition); *and* hulls or parts of hulls, for such ships.
See also M.L.9.

1416. Vessels, as follows:
(a) Fishing vessels and hulls therefor designed for speeds of 17 knots or over when in full load (design) condition;
(b) Seagoing vessels including coasters and hulls therefor not elsewhere specified designed for speeds of 20 knots or over when in full load (design) condition;
(c) Vessels with hulls and propulsion machinery made wholly or primarily of non-magnetic materials;
(d) New ships with decks and platforms specially designed or strengthened to receive weapons.
NOTE: The Admiralty or the Ministry of Transport, as appropriate, should be consulted about any vessels which contain any embargoed item or have arrangements for demagnetization.

1430. Buoyant electric conducting cable suitable for sweeping magnetic mines.

1441. Marine steam boilers designed to operate at temperatures of 1100° Fahrenheit and above.

1450. Automotive vehicles, tractors, lift trucks, not elsewhere specified, possessing or built to current military specifications differing materially from their normal commercial specifications.

1460. Aircraft and helicopters, aero engines and aircraft and helicopter equipment as follows:
(a) Aircraft and helicopters, not elsewhere specified, *except* those not containing or incorporating any Munitions List items (Group A) and which:
(i) are of types and series which have been in normal civil use for more than two years; *or*
(ii) being of types and series in normal civil use, are under 90,000 lb. empty weight (empty weight is understood to include normal installations and normal minimum crew, but does not include fuel or payload);
NOTE: Exporters are advised to consult the Ministry of Aviation about any proposal to sell aircraft to the Sino-Soviet Bloc.
(b) Aero-engines, not elsewhere specified;
NOTE: The Export Licensing Branch will consider applications for licences for the export of the following types of aero engines for use in civil aircraft and helicopters in the Sino-Soviet Bloc:
(i) turbo-prop, turbo-shaft and turbo-jet types and series which are the standard engines of aircraft and helicopters excepted from embargo under sub-items (a) (i) and (a) (ii) above or are equivalent to such engines;
(ii) piston types;
(c) Ground and airborne equipment, not elsewhere specified, developed solely or used mainly for aircraft and helicopters, *except* ground or airborne equipment of types in normal civil use.
See also M.L.10.

1485. Compasses and gyroscopic equipment as follows:
(a) Gyro compasses, North-seeking only, possessing one or more of the following characteristics:
(1) Automatic correction for the effects on compass accuracy of changes in ship's speed, acceleration, or latitude, other than manually set mechanical corrective devices;
(2) Provision for accepting ship's data as an electrical input;
(3) Provision for setting in corrections for current set and drift;
(4) Utilization of accelerometer, rate gyro, rate integrating gyros, or electrolytic levels as sensing devices;
(5) Provisions for determining and electrically transmitting ship's level reference data (roll, pitch) in addition to own ship's course data;
(b) Pressure proof ship's course indicators for submarines;
(c) Transmitting magnetic compasses specially designed for submarines;
(d) (i) Gyro-stabilizers for aircraft;
(ii) Automatic pilots for aircraft;
See Note under (e) below;
(e) Gyro-magnetic compasses;
NOTE: The Export Licensing Branch will consider applications for licences for equipment covered under sub-items (d) and (e) provided:
(A) They are of types and series which have been in normal civil use for more than two years and are standard equipment of aircraft excluded from control under Item 1460.
(B) The equipment is to be installed in civilian aircraft;
(f) Gyro-astro compasses;
(g) Gyro-stabilizers used for other purposes than aircraft control, *except* those for stabilizing an entire surface vessel;
(h) Automatic pilots used for other purposes than aircraft control, *except* marine types for surface vessels;
(i) Gyroscopes and accelerometers of very high precision and miniaturized gyroscopes and accelerometers which are designed for use in inertia navigation systems or in guidance systems of all types;
(j) Specially designed parts and components for the above, *except* for the specific equipment exported under (d) and (e).

Group H

Electronic Equipment including Communications and Radar

1501. Communication, navigation, direction finding and radar equipment, not elsewhere specified, as follows:
(a) Airborne communication equipment and specialized parts and components therefor;
NOTE: The Export Licensing Branch will consider applications for licences for the export of commercial airborne equipment needed to equip Sino-Soviet Bloc aircraft which participate in scheduled commercial flights to countries outside the Bloc and containing none of the following characteristics:
(i) Designed to operate at frequencies greater than 156 megacycles per second;
(ii) Designed for Single Side Band Operation;
(iii) Incorporating facilities for the rapid selection of more than 200* channels per equipment and/or facilities for the automatic tuning (other than by simple switching) of the antennae each time a channel is selected;
(iv) Incorporating facilities for providing a multiplicity of alternative output carrier frequencies controlled by a lesser number of piezo-electric crystals and not forming multiples of a common control frequency;
(v) Pressurized throughout;
(vi) Rated for continuous operation over a range of ambient temperatures extending from below −40° Centigrade to above +55° Centigrade;
(vii) Designed for modulating methods employing any form of digital modulation using time and frequency redundancy such as 'Quantized Frequency Modulation (Q.F.M.)';
* Applications for licences for equipment incorporating facilities for the rapid selection of 360 or fewer channels in the 118 to 136 megacycles per second frequency band, will also be considered if the equipment has been in normal civil use for at least two years;
(b) Navigation and direction finding equipment, not elsewhere specified (and specialized parts and accessories, specialized testing or calibrating equipment and training or simulating equipment, not elsewhere specified, therefor), as follows:
(1) Airborne navigation equipment and direction finding equipment as follows:
(i) Designed to make use of 'Doppler' frequency phenomena;
(ii) Utilizing the constant velocity and/or the rectilinear propagation characteristics of electromagnetic waves having frequency less than 4×10^{14} cycles per second (0.75 microns);
NOTE: The Export Licensing Branch will consider applications for licences for:
(1) the export of commercial airborne equipment needed to equip Sino-Soviet Bloc aircraft which participate in scheduled commercial flights to countries outside the Bloc provided that such equipment:

(a) is not designed to make use of hyperbolic grids at frequencies greater than 3 megacycles per second;
(b) is not transistorized; and
(c) is in conformity with the standards of the International Civil Aviation Organization (I.C.A.O.) and assures no function exceeding those required by these standards; and

(2) the export of the following equipment when the equipment is to be installed in civil aircraft of the Sino-Soviet Bloc:
(a) Very High Frequency Omni Directional Radio Range Equipment (V.O.R.);
(b) Instrument Landing Systems (I.L.S.);
(c) Commercial airborne equipment designed to make use of hyperbolic grids and operating at frequencies of less than 3 megacycles per second:

provided the equipment is not transistorized and is equivalent in all characteristics and performance to equipment used as standard equipment of aircraft not embargoed by Item 1460.

(iii) Pulse modulated altimeters;
(iv) Direction finding equipment operating at frequencies greater than 5 megacycles per second (other than equipment designed for search and rescue purposes provided that the receiver operates on a crystal controlled fixed frequency of 121.5 megacycles per second and that the determination of the D.F. bearing is not independent of the heading of the aircraft *and* provided that the D.F. antennae array is designed for operation at a fixed frequency of 121.5 megacycles per second);
(v) Pressurized throughout;
(vi) Rated for continuous operation over a range of ambient temperatures extending from below −40° Centigrade to above +55° Centigrade;

(2) Ground and marine equipment for use with airborne navigation equipment utilizing the constant velocity and/or the rectilinear propagation characteristics of electromagnetic waves having frequency less than 4×10^{14} cycles per second (0.75 microns);

NOTE: The Export Licensing Branch will consider applications for licences for:

(1) the export of ground equipment for use with airborne navigation equipment required for use at Sino-Soviet Bloc airports for servicing commercial flights from countries outside the Bloc provided that such equipment:
(a) is not designed to make use of hyperbolic grids at frequencies greater than 3 megacycles per second;
(b) is not transistorized; and
(c) is in conformity with the standards of the International Civil Aviation Organization (I.C.A.O.), and assures no function exceeding those required by these standards; and

(2) the export of the following equipment when the equipment is to be installed at civilian airports or for use on civil air routes in the Sino-Soviet Bloc:
(a) Very High Frequency Omni Directional Radio Range Equipment (V.O.R.);
(b) Instrument Landing Systems (I.L.S.);
(c) Ground equipment for use with commercial airborne equipment designed to make use of hyperbolic grids and operating at frequencies of less than 3 megacycles per second;

provided the equipment is not transistorized and is equivalent in all characteristics and performance to equipment used in connection with equipment mentioned in Note (2) to sub-item (1) (ii) above.

(3) Ground and marine direction finding equipment operating at frequencies greater than 5 megacycles per second:

(c) Radar equipment, not elsewhere specified, (and specialized parts and accessories, specialized testing or calibrating equipment and training or simulating equipment, not elsewhere specified, therefor), as follows:
(1) Airborne radar equipment;
(2) Ground and marine radar equipment, as follows:
(i) Radar equipment, not elsewhere specified, other than those normal equipments designed for pulse operation at frequencies between 1,300 megacycles per second and 1,660 megacycles per second, 2,700 megacycles per second and 3,900 megacycles per second, or 8,500 megacycles per second and 10,000 megacycles per second, having, in the case of marine radar, a peak output power to the aerial system of not greater than 75 kilowatts or, in the case of ground-based radar, having a peak output power to the aerial system of not greater than 50 kilowatts and a range of not greater than 50 nautical miles;

NOTE: The 50 nautical miles range is intended to refer to the maximum usable range on a target of 100 square metres.

(ii) Radar equipment incorporating permanent Echo Cancellation;
(iii) Radar equipment incorporating antennae systems for other than linear polarization;
(iv) Radar equipment utilizing other than conventional pulse modulation and signal processing techniques.

1502. Communication, detection or tracking equipment of a kind using infra-red radiation or ultrasonic waves; and specialized parts therefor.
See also M.L.15.

1503. Communication equipment employing tropospheric, ionospheric or meteoric scatter phenomena; and specially designed sub-assemblies, parts and test equipment therefor.

1507. 'Jamming' apparatus (i.e. apparatus specially designed to jam or otherwise interfere with radio reception); *and* specialized parts therefor.

1510. Location apparatus, underwater: apparatus for detecting or locating objects under water by magnetic or acoustic or ultrasonic methods, and specialized components of such apparatus, except marine depth sounders of a kind used solely for measuring the depth of water or the distance of submerged objects vertically below the apparatus.

NOTE: The Export Licensing Branch will consider applications for licences for the export of horizontally operating apparatus for fish finding.

1514. Pulse modulators capable of providing electric impulses of peak power exceeding 150 kilowatts or of a duration of less than 1/10th micro-second, or with a duty cycle in excess of 0.002; and pulse-transformer, pulse-forming equipment, or delay lines being specialized parts of such modulators.

1516. Radio receivers, panoramic (being receivers which search automatically a part of the radio-frequency spectrum and indicate the signals received); and specialized parts therefor.

1517. Radio transmitters and components, not elsewhere specified, (*except* radio link and relay equipment) as follows:
(a) Transmitters or transmitter amplifiers designed to operate:
(i) At output carrier frequencies between 108 and 156 megacycles per second (other than equipment designed for search and rescue purposes where such equipment comprises an omni directional beacon and operates on a single crystal controlled fixed frequency of 121.5 megacycles per second);

NOTE: The Export Licensing Branch will consider applications for licences for the export of equipment required for use at Sino-Soviet Bloc airports for servicing commercial flights from countries outside the Bloc and containing none of the characteristics mentioned under sub-item (b).

(ii) At output carrier frequencies greater than 223 Mc/seconds other than television broadcasting transmitters and amplifiers therefor operating between 470 and 585 Mc/seconds or between 610 and 940 Mc/seconds;

(b) Transmitters or transmitter amplifiers designed to provide any of the following features:
(i) Any system of pulse modulation. (This does not include amplitude, frequency or phase modulated television or telegraphic transmitters.)
(ii) Rated for operation over a range of ambient temperatures extending from below —40° Centigrade to above +55° Centigrade.
(iii) Facilities providing a multiplicity of alternative output carrier frequencies controlled by a lesser number of piezo-electric crystals and not forming multiples of a common control frequency.

(c) Components and sub-assemblies, including modulators and modulation amplifiers, specially designed for use in transmitters covered by sub-items (a) and (b).

1518. Telemetering and telecontrol equipment suitable for use with aircraft (piloted or pilotless), space vehicles or weapons (guided or unguided).

1519. Telegraph equipment, as follows :
(a) Equipment (machines), mechanical, electro-mechanical, or electronic, used to translate the information contained in written or printed text into electrical waveforms suitable for transmission over communication circuits at any speed greater than 200 words per minute or 150 bauds, whichever is the less; *except* equipment operating at a speed of 300 bauds where the corresponding number of words does not exceed 65 words per minute;
(b) Equipment designed to accept such electrical waveforms and display the information from them in visible form;
(c) Terminal equipment, not elsewhere specified, capable of transmitting and/or receiving digital data at a rate in excess of 2,000 bits per second (bauds) or at a rate (applicable to single channels or to each sub-channel in a multi-channel system) in bits per second (bauds) numerically in excess of 75 per cent. of the channel (or sub-channel) band-width in cycles per second;
(d) Specialized component parts and accessories for such equipment.

1520. Radio relay communications equipment and specialized components and sub-assemblies therefor, other than short-range and low power links for transmissions between the camera or studio and the television transmitter.

1521. Amplifiers, not elsewhere specified, as follows:
(a) Designed to operate at frequencies in excess of 500 Mc/second;
(b) Tuned amplifiers having a bandwidth (defined as the band of frequencies over which the power amplification does not drop to less than one-half of its maximum value) which exceeds 10 Mc/second or 10 per cent. of the mean frequency, whichever is less. (The mean frequency is defined as the arithmetic mean between the frequencies at which the power amplification is one-half of its maximum value);
(c) Untuned amplifiers having a bandwidth, as defined in sub-item (b) above, which exceeds 10 megacycles per second;
(d) Direct current amplifiers having a noise level (referred to the input circuit of 10^{-16} watts or less and/or a zero drift in 1 hour corresponding to a change in output power of 10^{-16} watts or less;
(e) Parametric amplifiers with a noise figure of merit of 5 decibels or less measured at a temperature of 17° Centigrade; paramagnetic amplifiers; other devices which amplify by means of simulated electromagnetic radiation; specially designed parts therefor; and any equipment containing such amplifiers or devices.

1523. Communication transmission equipment, as follows :
(a) Terminal and intermediate repeater or amplifier equipment designed to deliver, carry, or receive frequencies higher than 36 kilocycles per second into, or in, a communication system;
NOTE : The Export Licensing Branch will consider applications for licences for the export to Sino-Soviet Bloc destinations of standard commercial frequency translating terminal equipment, accessories and/or units designed for operation at carrier frequencies of 96 kilocycles per second and designed for high-quality music signals of a band-width not exceeding 12 kilocycles per second, provided the equipment will be so used within the Bloc.
(b) Multi-channel telegraph terminal transmitting and receiving equipment;
NOTE : It is not intended to embargo telemetering, telecommand and telesignalling equipment designed for industrial purposes employing time division multiplexing in which the total speed of operation is less than 150 bauds.
(c) Specialized components, accessories, and sub-assemblies for the above equipment.
NOTE : In cases weher the equipment is to be installed in circuits directly connecting densely populated industrial areas of Sino-Soviet Bloc countries with communication systems of countries outside the Bloc, the Export Licensing Branch will consider applications for licences for the export of communication transmission equipment having the following characteristics :
(1) Terminal and intermediate repeater or amplifier equipment designed to deliver, carry or receive not more than 60 voice channels of 4 kilocycles per second each;
(2) Multi-channel telegraph terminal transmitting or receiving equipment transmitting or receiving not more than 6 channels and/or designed for speeds not exceeding those defined in Item 1519.

1525. Coaxial-type cables (including submarine cables) specially esigned for telecommunication purposes (including radar) other than those specially designed or in common use for domestic radio and television receivers.
NOTE: The Export Licensing Branch will consider applications for licences for the export of submarine cables in cases where it is to be installed in circuits directly connecting Sino-Soviet Bloc countries with communication systems of countries outside the Bloc.

1526. Communication cable (including submarine cable) of any type containing more than one pair of conductors and containing any conductor, single or stranded, exceeding 0.66 millimetre in diameter.
NOTE: The Export Licensing Branch will consider applications for licences for the export of :
(1) Cables containing any number of conductors up to 0.9 millimetres in diameter where these cables have *not* been manufactured as long distance communication carrier frequency cables; and
(2) Cable neither containing more than two pairs of conductors nor containing any conductor, single or stranded, exceeding 1.4 millimetres in diameter where the cable is to be installed in circuits directly connecting densely populated industrial areas of Sino-Soviet Bloc countries with communications systems with countries outside the Bloc.
It may also be possible to grant export licences very exceptionally on occasions for specified projects within the Bloc for such things as railway signalling or communications between Bloc and non-Bloc countries. Manufacturers receiving inquiries from the Bloc for purposes of this nature should consult Commercial Relations and Exports Department, Board of Trade.

1527. Equipment designed to provide secrecy facilities on either voice or telegraph, line or radio communication circuits other than those systems making use of frequency inversions or band scrambling techniques.

1529. Electronic measuring, testing, or calibrating instruments, not elsewhere specified, having one or more of the following characteristics :
(a) Designed for use at frequencies in excess of 500 megacycles per second, *except* radio spectrum analyzers (see Item 1533) and signal generators or mixers using self excited oscillators, with an overall frequency accuracy poorer than 1.0 per cent. operating at less than 1,000 megacycles per second, and not having more than 2 rated output reference levels;
(b) Testing instruments rated to maintain their specified operating data when operating over a range of ambient temperatures extending from below −25° Centigrade to above +55° Centigrade.
NOTE : Frequency measuring equipment which was formerly embargoed under this item is now covered by Item 1593.

1530. Apparatus for automatically sorting electronic components in respect of their electrical characteristics.

1533. Radio spectrum analyzers (being apparatus capable of indicating the single-frequency components of multifrequency oscillations) as follows :
(a) Designed to operate at frequencies over 500 megacycles per second;
(b) Designed to operate at frequencies over 300 Mc/second and using interchangeable heads (i.e. radio-electric frequency tuning systems) and incorporating integral sweep facilities;
(c) Having a display bandwidth in excess of 12 megacycles per second;
(d) Specialized components, accessories and parts therefor.

1537. Electromagnetic wave guides and components therefor, as follows:
(a) Rigid waveguides and components designed for use at frequencies in excess of 12,500 megacycles per second;
(b) Flexible waveguides of all types;
(c) Waveguides having a bandwidth ratio greater than 1.5 : 1;
(d) Waveguide components, not elsewhere specified, as follows:
(i) Directional couplers having a bandwidth ratio greater than 1.5 : 1 and directivity over the band of 15 decibels or more;
(ii) Rotary joints capable of transmitting more than one isolated channel or having a bandwidth greater than 5 per cent. of the centre mean frequency;
(iii) Magnetic, including gyro-magnetic, waveguide components;
(e) Pressurized waveguides and specialized components therefor;
(f) T.E.M. mode devices using magnetic, including gyro-magnetic, properties.

1541 Cathode-ray tubes, as follows:

(a) with a resolving power of 500 or more lines per inch (20 lines per millimetre), using the shrinking raster method of measurement;

NOTE: The Export Licensing Branch will consider applications for licences for the export of tubes with a resolving power of up to 800 lines per inch (32 lines per millimetre) which have been specially designed for commercial television, cinema or photographic applications.

(b) With writing speeds of more than 3,000 kilometres per second;

(c) With three or more electron guns, except three-gun colour television tubes designed for entertainment use;

(d) Alpha-numeric and similar data or information display tubes, display being obtained either by scanning or other means excluding those tubes in which the displayed position of each character is fixed.

1544. Semi-conductor diodes, including rectifier diodes and switching diodes, but excluding photodiodes (see Item 1548) as follows:

(a) Any semiconductor diode in which the bulk material is other than silicon, germanium, selenium or copper-oxide;

(b) Signal diodes (including mixer, frequency-changing and switching diodes):

(i) Point contact type diodes in which the bulk material is silicon and which are designed for use at input frequencies greater than 300 megacycles per second;

(ii) Point contact type diodes in which the bulk material is germanium and which are designed for use at input frequencies greater than 1,000 megacycles per second;

(iii) Junction type diodes in which the bulk material is silicon and which are designed for use at input frequencies greater than 1 megacycle per second or which are designed for switching rates (repetition frequency) higher than 100 kilocycles per second.

NOTE: This sub-item will normally include switching type diodes having a recovery time less than 2 microseconds. The recovery time is to be specified for a decrease of reverse current to a value of 100 microamps or less and measured with a forward current and a reverse voltage are typical for the diode in question.

(iv) Junction type diodes in which the bulk material is germanium and which are designed for use at input frequencies greater than 300 Mc/second or which are designed for switching rates (repetition frequency) higher than 1 megacycle per second.

NOTE: This sub-item will normally include switching type diodes having a recovery time of less than 0.2 microseconds. The recovery time is to be specified for a decrease of reverse current to a value of 100 microamps or less and measured with a forward current and a reverse voltage which are typical for the diode in question.

(c) (i) Power diodes in which the rated peak inverse voltage exceeds 1,000 volts per junction at 25° Centigrade under any conditions of cooling;

(ii) Controlled diodes, i.e. semi-conductor multiple-junction devices for applications similar to those of grid-controlled gas-filled tubes, designed for use at switching rate (repetition frequency) higher than 100 kilocycles per second.

1545. Transistors and related devices (or related semi-conductor amplifying devices such as fieldistors, spacistors, and technetrons) and specialized parts therefor, as follows:

(a) Of any type using any semi-conductor material having four or more active junctions within any single block of semi-conductor material;

(b) Of any type using a bulk semi-conductor material other than germanium;

(c) Using germanium as the bulk semi-conductor material and having any of the following characteristics:

(i) An average f alpha of less than 50 Mc/second and designed to have a maximum collector dissipation (in watts) multiplied by the average f alpha (in Mc/second) greater than 7.5;

(ii) An average f alpha of 50 to 150 Mc/second and designed to have a maximum collector dissipation greater than 150 milliwatts;

(iii) An average f alpha greater than 150 megacycles per second.

(d) Specially designed or rated for use as a switching transistor for switching rates (repetition frequency) greater than 500 kc/second. This item will normally include switching type transistors with an average f alpha greater than 6 Mc/second.

NOTES:

1. This item is intended to cover all devices incorporating a semi-conducting crystal of any material with three or more electrical connections or with only two such connections where four or more active junctions exist within a single block of semi-conductor material, which are used as amplifiers, oscillators, trigger devices, etc., or combinations thereof in electronic circuits. For photo transistors, see Item 1548.

2. The maximum collector dissipation is to be defined as the continuous dissipation measured at an ambient temperature of 25° Centigrade under any cooling condition.

3. The average f alpha is defined as the f alpha at which the major production of a particular type of transistor occurs.

Where the average f alpha is not quoted or known, this value shall be taken as 1.5 times the minimum f alpha.

4. f alpha is defined as the frequency at which the modulus of the current gain in the common base connection has decreased to 0.707 of its low frequency value.

5. Where f^1 (the frequency at which the modulus of the current gain in the common emitter connection is equal to 1) is quoted instead of f alpha, f^1 may be regarden as 0.8 times f alpha.

1546. Dendritic produced forms of any semi-conductor material, or combinations thereof, suitable for use in diodes or transistors.

NOTE: The term 'dendritic' signifies a ribbon-like product of semi-conductor material which may be drawn in various widths, thicknesses and lengths and which may represent processing stages from a relatively pure form of the material through advanced stages of treatment.

1548. Photo cells, as follows:

(a) Photoelectric cells, ¬hoto-conductive cells (including photo-transistors and similar cells) with a peak sensitivity at a wave length longer than 12,000 angstroms;

(b) Photo-transistors (photo-conductive cells including photo-diodes) with a response time constant of 1 millisecond or less measured at the operating temperature of the cell for which the time constant reaches a minimum.

NOTE: Germanium photo devices with a peak response less than 17,500 angstroms are specifically excluded from embargo.

1549. Photomultiplier tubes of all types for which the maximum sensitivity occurs at wavelengths longer than 7,500 angstroms.

1550. Thermal detecting cells, i.e. bolometers and thermocouple detectors, radiant energy types only, with a response time constant of less than 10 milliseconds measured at the operating temperature of the cell for which the time constant reaches a minimum.

1553. Flash-discharge type X-ray tubes.

1555. Image intensifiers, broad image converters and electronic storage tubes, including memory transformers of radar pictures and ruggedized vidicon-type tubes (excluding commercial standard television broadcasting camera tubes and commercial standard X-ray amplifier tubes).

1558. Valves (tubes) electronic, and specialized parts, as follows:

(a) (i) Valves rated for CW operation over the frequency range 300-600 megacycles per second and for which (at any part of this frequency range and under any condition of cooling) the product of frequency of operation in megacycles per second squared and the power output in watts from the anode(s) of a single envelope at this frequency exceeds 10^7, when the valve is operating in Class C telegraphy key down conditions or in Class C FM telephony conditions, or, if performance under these conditions is not known, the product of declared maximum frequency of full ratings in megacycles per second squared and the maximum rated anode dissipation per valve in watts exceeds 5×10^6;

(ii) Valves rated for operation above 600 megacycles per second;

(iii) Valves rated for pulse operation above 300 megacycles per second;

(iv) Valves having external anode(s) rated for operation above 300 megacyeles per second;

NOTE: Sub-item (a) of the definition is not intended to embargo any single-ended glass envelope tube which has a standard 7 pin miniature or 9 pin Noval base and is in standard use in civilian electronic equipment.

(b) Valves, other than conventional types such as diodes, triodes, tetrodes, pentodes, etc., in which the velocity of the electrons is utilized as one of the functional parameters including but not limited to klystrons, travelling wave tubes and magnetrons;

(c) Indirectly heated valves of a kind that can be passed through a circular hole of 7.2 millimetres in diameter;

(d) Valves designed to withstand at least one of the following tests:

(i) Sinusoidal vibration at peak accelerations greater than 5 g for a total period in excess of 100 hours at an one frequency between 25 and 170 cycles per second;

(ii) Swept frequency sinusoidal vibrations between 60 and 1,000 cycles per second, with a minimum swept frequency ratio of 5 to 1, at peak acceleration greater than 4 g for a total period in excess of 200 hours;
(iii) Acceleration of short duration (shock) greater than 1,000 g;
(e) Valves constructed with ceramic envelopes and designed for frequencies in excess of 60 megacycles per second;
(f) Valves designed for operation in ambient temperatures exceeding 100° Centigrade.

1559. Thyratron and modulator gas-discharge tubes, as follows:
(a) Those rated for continuous operation with peak current and peak voltage exceeding 100 amperes and 9,000 volts at a pulse repetition frequency of 200 or more pulses per second;
(b) Hydrogen thyratrons of any rating.
NOTE: A 'thyratron' is defined as any hot cathode gas-filled tube containing three or more electrodes in which anode current flow is initiated by a control electrode.

1560. Components and parts used as resistive, inductive and capacitive elements in electronic circuits, not elsewhere specified, designed for and/or capable of reliable performance in relation to their electrical and mechanical characteristics and maintaining their design service lifetime while operating:
(a) over the whole range of ambient temperatures from below − 45° Centigrade to above + 100° Centigrade; *or*
(b) at ambient temperatures of 200° Centigrade or higher.

1561. Materials specially designed and manufactured for use as absorbers of electromagnetic waves having frequencies greater than 2×10^8 cycles per second, and less than 3×10^{12} cycles per second.

1562. Tantalum electrolytic capacitors not elsewhere specified as follows:
(a) All types designed to operate at temperatures exceeding 85° Centigrade;
(b) Sintered electrolytic capacitors;
(c) Electrolytic capacitors constructed with foils.

1564. Electronic equipment and components, not elsewhere specified, as follows:
(a) Assemblies and sub-assemblies constituting one or more functional circuits with a component density greater than 75 parts per cubic inch and equipment containing such assembly or sub-assembly;
(b) Modular insulator panels (including wafers) mounting single or multiple electronic elements and specialized parts therefor.

Group I

Scientific Instruments and Apparatus, Servomechanisms and Photographic Equipment

1565. Electronic computers and related equipment, not elsewhere specified, as follows:
(a) Analogue computers with 1 or more of the following characteristics:
(i) Containing a summer with a rated accuracy better than 1 part in 5,000 parts, or a multiplier or arbitrary adjustable function generator with a rated accuracy better than 1 part in 1,000 parts;
(ii) Containing or capable of incorporating a total of more than 75 summers, integrators, multipliers or function generators;
(iii) Incorporating facilities for automatic insertion or alteration of problem set-up; *or*
(iv) Incorporating any unit designed to function solely as a memory;
(b) Analogue computers designed or modified for use in airborne vehicles, missiles or space vehicles and rated for continuous operation at temperatures from below − 45° Centigrade to above +55° Centigrade; and equipment or systems incorporating such computers;
(c) Other analogue computers;
(d) Digital computers using drum or disc type primary memory and possessing:
(i) A total rated directly addressable storage capacity in excess of 1 million bits (the same limit defines both the maximum capacity a single storage equipment may possess and the combined capacity where multiple equipments are used); *or*
(ii) A capability of storing in excess of 250 bits per linear inch of single track (this limitation applies to each storage equipment involved);
(e) Other digital computers and digital differential analyzers (incremental computers) designed or modified for use in airborne vehicles, missiles or space vehicles and rated for continuous operation at temperatures from below − 45° Centigrade to above +55° Centigrade; and equipment or systems incorporating such computers or analyzers;
(f) Digital differential analyzers (incremental computers), as follows:
(i) Incorporating more than 50 integrators; *or*
(ii) Incorporating integrators with an increment cycle time of less than 1 millisecond (or an iteration rate in excess of 1,000 per second);
(g) Digital computers and digital differential analyzers (incremental computers) other than those in (d), (e) and (f) above;
(h) Specialized parts, components, sub-assemblies and accessories, not elsewhere specified.

NOTES: 1. The Export licensing Branch will consider applications for licences for the export to the Sino-Soviet Bloc of (i) computers covered by sub-items (c) and (g); and (ii) specialized parts, components, sub-assemblies and accessories, not elsewhere specified, therefor covered by sub-item (h) subject to certain conditions. The principal conditions are:
(A) that the equipment was designed for and is primarily used in non-strategic applications;
(B) the equipment will be used in the Sino-Soviet Bloc primarily for the specific non-strategic applications for which the export would be approved and that the number, type and characteristics of such equipment are normal for the approved use; and
(C) the number of embargoed memory or storage equipments included in equipment covered by sub-item (g) does not exceed 12;
2. Where the word 'rated' is used it refers to the rated characteristics applied by the manufacturer; however, where the equipment has been modified to improve the rated characteristics specified in the definition the improved characteristics of the equipment shall be governing.
3. All references to numbers of 'bits' includes those for checking, synchronizing, etc.

1566. Equipment specially designed to produce electronic assemblies:
(a) By depositing or printing on insulating panels (including plates and wafers), or otherwise forming *in situ*, component parts other than basic wiring; or
(b) By automatically inserting and/or soldering components on insulating panels (including plates and wafers), to which wiring is applied by printing or other means; or
(c) By automatically or semi-automatically assembling, wiring and/or packaging mounted modular insulated panels (including plates and wafers) referred to in (a) and (b) above.

1568. Control equipment, as follows:
(a) All classes of devices, regardless of other characteristics, identified in sub-items (b), (c), (d), (e), (f), (g), and (1) below, which are designed to operate below − 55° Centigrade or above +125° Centigrade;
(b) Synchros and resolvers (and special instruments rated to have the same characteristics as synchros and resolvers in (i) and (ii) below, such as Microsyns, Synchro-Tels and Inductosyns), possessing any of the following characteristics:
(i) A rated electrical error of 10 minutes or less *or* of 0.5 per cent. or less of maximum output voltage;
(ii) A rated dynamic accuracy for receiver types of 1 degree or less, except that for units of size 30 (3 inches in diameter) or larger a rated dynamic accuracy of less than 1 degree;
(iii) Multi-speed from single shaft types;
(iv) Of size 11 (1.1 inches in diameter) and smaller;
(v) Employing solid state Hall effect;
(vi) Designed for gimbal mounting;
(c) Amplifiers, electronic or magnetic, specially designed for use with resolvers, as follows:
(i) Isolation types having a variation of gain constant (linearity of gain) of 0.5 per cent. or better;
(ii) Summing types having a variation of gain constant (linearity of gain) or an accuracy of summation of 0.5 per cent. or better;
(iii) Employing solid state Hall effect;
(d) Induction potentiometers (including function generators and linear synchros), linear and non-linear, possessing any of the following characteristics:
(i) A rated conformity of 0.5 per cent. or less, or of 18 minutes or less;
(ii) Of size 11 (1.1 inches in diameter) and smaller;
(iii) Employing solid state Hall effect;
(iv) Designed for gimbal mounting;

(e) Induction rate (tachometer) generators, synchronous and asynchronous, possessing any of the following characteristics:
  (i) A rated linearity of 0.5 per cent. or less;
  (ii) Temperature-compensation or temperature-correction;
  (iii) Of size 11 (1.1 inches in diameter) and smaller;
  (iv) Employing solid state Hall effect;
(f) Servo motors (gear-head or plain) as follows:
  (i) Designed to operate from power sources of more than 300 cycles per second (*except* those designed to operate from power sources of over 300 cycles per second up to and not exceeding 400 cycles per second with a temperature range of from − 10° Centigrade to + 55° Centigrade);
  (ii) Designed to have a torque-to-inertia ratio of 10,000 radians per second, per second or greater;
  (ii) Incorporating special features to secure internal damping;
  (iv) Of size 11 (1.1 inches in diameter) and smaller;
  (v) Employing solid state Hall effect;
(g) Potentiometers (and special instruments rated to have the same characteristics as potentiometers in (1) and (2) below, such as Vernistats), as follows:
  (1) Linear potentiometers having a constant resolution and a rated linearity of 0.1 per cent. or less;
  (2) Non-linear potentiometers having a variable resolution and a rated conformity of:
    (i) 1 per cent. or less when the resolution is inferior to that obtained with a linear potentiometer of the same type and of the same track length; *or*
    (ii) 0.5 per cent. or less when the resolution is better than or equal to that obtained with a linear potentiometer of the same type and of the same track length;
  (3) Designed for gimbal mounting;

NOTE: This sub-item is not intended to embargo potentiometers using only switched elements.

(h) Direct current and alternating current torquers, i.e. torque motors specially designed for gyros and stabilized platforms;
(i) Electro-optical devices designed to monitor relative rotation of remote surfaces;
(j) Synchronous motors, as follows:
  (i) Having synchronous speeds in excess of 3,000 revolutions per minute;
  (ii) Designed to operate from power sources of more than 400 cycles per second;
  (iii) Designed to operate below —10° Centigrade or above +55° Centigrade;
  (iv) Of size II (1.1 inches in diameter) and smaller;
(k) Ball-and-disc or cylinder-and-ball mechanical integrators; and mechanical ball resolvers;
(l) Analogue-to-digital and digital-to-analogue converters, as follows:
  (1) Electrical-input types possessing:
    (i) A peak conversion rate capability in excess of 50,000 complete conversions per second;
    (ii) An accuracy in excess of 1 part in more than 10,000 of full scale; *or*
    (iii) A figure of merit of 5 × 10^6 (derived from the number of complete conversions per second divided by the accuracy);
  (2) Mechanical input types (including but not limited to shaft position encoders and linear displacement encoders but excluding complex servo-follower systems) as follows:
    (i) Rotary types with an accuracy or maximum incremental accuracy better than ± 1 part in 10,000 of full scale, *or* of size 11 (1.1 inches in diameter) and smaller;
    (ii) Linear displacement types having an accuracy of better than ± 5 microns;
  (3) Employing solid state Hall effect;
(m) Specially designed parts, components, sub-assemblies and test equipment (including adapters, couplers, etc.) for the above.

1570. Thermoelectric materials and devices as follows:
(a) Thermoelectric materials with a maximum product of the figure of merit (Z) and the temperature (T in °Kelvin) in excess of 0.75;
(b) Junctions and combinations of junctions using any of the materials in (a) above;
(c) Heat absorbing and/or electrical power generating devices containing any of the junctions in (b) above;
(d) Other power generating devices which generate in excess of 10 watts per pound or of 500 watts per cubic foot of the devices' basic thermoelectric components;
(e) Specialized parts, components and sub-assemblies, not elsewhere specified, for the above devices.

NOTES: 1 The figure of merit (Z) equals Seebeck coefficient squared divided by the product of electrical resistivity and thermal conductivity.

2. The weight and cubic measurements in (d) above are not intended to encompass the complete device but to include only the thermoelectric elements and assembly and the components for pumping calories. Other components, such as heating and/or cooling sources or containers, device frames or stands and control equipment are not to be included in the calculations.

1571. Magnetometers as follows:
(a) Fluxgate;
(b) Electron beam sensing;
(c) Paramagnetic;
(d) Nucleonic;
and specialized parts therefor.

NOTE: *Paramagnetic*, as used above, refers to the sensing of changes in magnetic field strength by measurement of the effects of such changes in the electron spin phenomena.

1572. Recording and/or reproducing equipment, not elsewhere specified, as follows:
(a) Those using magnetic techniques *except* those specifically designed for voice or music (such excluded equipment may contain one control channel);
(b) those using electrothermal and/or electrostatic recording techniques employing electron beams, operating in a vacuum and/or employing other means to provide a charge pattern directly on the recording surface; and specialized equipment for the read-out of material so recorded;
(c) Specialized parts, components and recording media for use with equipment described in sub-items (a) and (b) above.

NOTE: 1. The Export Licensing Branch will consider applications for licences for the export to the Sino-Soviet Bloc under sub-item (a) above of reasonable numbers of the equipments described below and of amounts of materials in sub-item (c) normal to the stated Bloc use for which the equipment was approved.

Equipment primarily designed for the recording and/or reproducing (read-out) of:
(i) sinusoidal information on a continuous unidirectional basis and having an aggregate direct recording and/or reproducing bandwidth capability not exceeding 50 kilocycles per second with the tape running continuously at maximum rated speed, irrespective of the number of tracks;
(ii) coded data having a maximum direct recording and/or reproducing bandwidth of less than 100 kilocycles per second with the tape running continuously at maximum rated speed, irrespective of the number of tracks, provided that the tape transport is not controlled by the read-in or read-out device or connected to the latter by means of a computer;
except for equipment having one of the following characteristics:
(1) Ruggedized;
(2) Rated for continuous operation in ambient temperatures from below —10° Centigrade to above +55° Centigrade;
(3) Specially designed for underwater use;
(4) A rated tape speed in excess of 60 inches per second;
(5) A rated start and/or stop time of less than 50 milliseconds; *or*
(6) Recording and/or reproducing heads of the rotary or floating types or which were designed for use in equipment with characteristics superior to those set forth in (i) and (ii) above; and
provided (1) that the equipment was designed for and is primarily used in non-strategic applications and (2) that the specific shipments will be used in the Sino-Soviet Bloc for a specific installation which is primarily civilian in character and will not be used in relation to computers or to embargoed equipment or materials; and that the number, type and characteristics of such equipment are normal for the proposed use.

NOTE: 2. In sub-item (c) the term 'recording media' is intended to include all types and forms of specialized recording media employed in such recording techniques, including, but not limited to, tape, drums, discs and matrices.

NOTE: 3. Sub-item (b) of this definition is not intended to cover document copying equipment which employs electrothermal and/or electrostatic techniques to reproduce on specially sensitized media documents with which the media are in physical contact at the time of reproduction.

1576. Centrifugal testing apparatus or equipment possessing *any* of the following characteristics:
(a) Driven by a motor or motors having a total rated horsepower greater than 400 horsepower;
(b) Capable of carrying a payload of 250 pounds or more;
(c) Capable of exerting a centrifugal acceleration of 8 or more 'g' on a payload of 200 pounds or more.

1579. Ion microscopes having a resolving power better than 10 angstroms.

1584. Oscilloscopes (cathode ray and specialized parts therefor, as follows:
(a) Oscilloscopes possessing any of the following characteristics:
 (i) A bandwidth greater than 12 megacycles per second (defined as the band of frequencies over which the deflection on the cathode ray tube does not fall below 70.7 per cent. of that at the maximum point measured with a constant input voltage to the amplifier);
 (ii) A time base shorter than 0.04 microseconds per centimetre;
 (iii) Containing or designed for:
  (i) The use of one or more cathode ray tubes having three or more electron guns; or
  (ii) The use of cathode ray memory tubes;
 (iv) Employing accelerating potentials in excess of 5,000 volts;
(b) Specialized parts and accessories as follows:
 Amplifiers and pre-amplifiers having a bandwidth, defined as in (a) (i) (above) greater than 12 megacycles per second.
(c) Electronic devices for stroboscopic analysis of a signal (i.e. sampling devices), whether sub-assemblies or separate units, designed to be used in conjunction with an oscilloscope to permit the analysis of recurring phenomena, which increase the capabilities of an oscilliscope to permit measurements within the limits of equipment embargoed under sub-item (a) (i) above and/or to permit the achieving in an oscilloscope of a time-base of less than 0.04 microseconds per centimetre.

1585. Photographic equipment as follows:
(a) High-speed cinema recording cameras employing:
 (i) Film widths 35 millimetres or narrower and recording at rates exceeding 3,000 frames per second in the case of equipment using as the lighting source a steady light flow and 10,000 frames per second in the case of equipment using as the lighting source flash equipment connected to the unwinding system;
 (ii) Film widths greater than 35 millimetres and recording at rates exceeding 64 frames per second;
(b) Other high speed cameras capable of recording at rates in excess of 250,000 frames per second;
(c) Photographic micro-flash equipment capable of giving a flash of 1/100,000 second or shorter duration, at a minimum recurrence frequency of 200 flashes per second.
(d) Photographic systems specially designed for use in space vehicles.
 See also M.L.12.

1587. Quartz crystals (worked or unworked) and plates, radio grade only.
NOTE: This item covers all quartz crystals having piezo-electric qualities suitable for electronic applications irrespective of their grade, quality, dimensions, form or extent of working of such crystals, excluding the following quartz crystals:
(i) natural gem stones;
(ii) natural quartz of optical quality having undergone advanced processing so as to obtain the recognized physical characteristics for optical use, i.e., those having undergone, once the product's optical axis has been determined, the operations of roughing-down, blanking, setting (being worn down by the use of abrasives of gradually increasing fineness of grain) and final surface polishing so as to give the finished product, within very close tolerances, the curvature rays, dihedral angles, etc. ensuring the desired physical characteristics.

1588. Ferritic materials and other materials composed of crystals having spinel structures, assemblies thereof and devices containing them, not elsewhere specified, as follows:
(a) Monocrystals of ferrites and garnets, synthetic only;
(b) Single aperture forms possessing any of the following characteristics:
 (i) Switching speed of 0.5 microsecond or less at the minimum field strength required for switching at 40° Centigrade;
 (ii) A maximum dimension less than 45 mils (1.14 millimetres);
(c) Multi-aperture forms with fewer than 10 apertures possessing any of the following characteristics:
 (i) Switching speed of 1 microsecond or less at the minimum field strength required for switching at 40° Centigrade;
 (ii) A maximum dimension less than 100 mils (2.54 millimetres);
(d) Multi-aperture forms having 10 or more apertures;
(e) Thin film memory storage or switching devices;
(f) Electrical filters in which the coupling element makes use of the electromechanical properties of ferrites;
(g) Materials suitable for application in electromagnetic devices making use of the gyro-magnetic resonance phenomenon.

1593. Measuring, calibrating, counting, and time interval measuring equipment, whether or not incorporating frequency standards, having one or more of the following characteristics:
(a) (i) Consisting of, or containing, frequency measuring equipment or frequency standards designed for other than ground laboratory use with an accuracy better than 1 part in 10^7;
 (ii) Consisting of, or containing, ground laboratory frequency standards or frequency measuring equipment incorporating frequency standards with a stability over 24 hours of 1 part in 10^9 or better;
(b) Designed for use at frequencies in excess of 500 megacycles per second;
(c) Designed to provide a multiplicity of alternative output frequencies controlled by a lesser number of piezo-electric crystals or an internal or external frequency standard and not forming multiples of a common control frequency;
(d) Counting equipment capable of resolving at normal input levels successive input signals with less than 0.5 microsecond time difference:
(e) Time interval measuring equipment containing counting equipment as specified in sub-item (d) above.

Group J

Metal, Minerals and their Manufactures

In this Group:
Raw materials covers all materials from which the metal can be usefully extracted, i.e. ores, concentrates, matte, regulus, residues and dross (ashes); and
Unless provision to the contrary is made in particular items of the definition, the words metal and alloys cover all crude and semi-fabricated forms as follows:
Crude forms:
Anodes, balls, bars (including notched bars and wire bars), billets, blocks, blooms, brickets, cakes, cathodes, crystals, cubes, dice, grains, granules, ingots, lumps, pellets, pigs, powder, rondelles, shot, slabs, slugs, sponge, sticks;
Semi-fabricated forms (whether or not coated, plated, drilled or punched):
 (i) Wrought or worked materials fabricated by rolling, drawing, extruding, forging, impact extruding, pressing, graining, atomizing and grinding, i.e. angles, channels, circles, discs, dust, flakes, foil and leaf, forgings, plates, powder, pressings and stampings, ribbons, rings, rods (including bare welding rods, wire rods, and rolled wire), sections, shapes, sheets, strip, pipe and tube (including tube rounds, squares and hollows), drawn or extruded wire;
 (ii) Cast material produced by casting in sand, die, metal, plaster or other types of moulds, including high pressure castings, sintered forms, and forms made by powder metallurgy.

1601. Anti-friction bearings, not elsewhere specified, as follows:
(a) All ball and cylindrical roller bearings having an inner bore diameter of 10 millimetres or less and tolerances of ABEC 5, RBEC 5 (or equivalents) or better and either or both of the following characteristics:
 (i) Made of special materials, i.e., with rings, balls or rollers made from any steel alloy or other material except the following:
  low-carbon steel; SAE-52100 high carbon chromium steel; SAE-4615 nickel molybdenum steel; or equivalents; (Partial illustrative examples of special materials for this purpose are: high speed tool steels; stainless steels; monels; beryllium);
 (ii) Manufactured for use at normal operating temperatures over 150° Centigrade (302° Fahrenheit) either by use of special materials or by heat treatment;

(b) All ball and cylindrical roller bearings (exclusive of separable ball bearings and thrust ball bearings) having an inner bore diameter exceeding 10 millimetres and having tolerances of ABEC 7, RBEC 7 (or equivalents) or better and either or both of the characteristics in (a) (i) or (a) (ii) above;
(c) Bearing parts as follows:
Outer rings, inner rings, retainers, balls, rollers and sub-assemblies useable only for bearings covered by sub-items (a) and (b).

1631. Magnetic metals in any form possessing one or more of the following characteristics:
(a) Grain oriented sheet or strip of a thickness of 0.2 millimetre (0.008 inch) or less;
(b) Initial permeability 50,000 or over;
(c) Remanence 98 per cent. or over of maximum flux for materials having magnetic permeability;
(d) A composition capable of an energy product greater than six times 10^6 gausses/oersteds, or containing more than 25 per cent. cobalt;
(e) Core loss of 1 watt per kilogram (0.45 watt per pound) or less at B = 13000 gausses and at 50 cycles per second or of 1.36 watts per kilogram (or 0.62 watt per pound) or less at B = 15000 gausses and at 50 cycles per second, for grain oriented sheet and strip of a thickness of 0.31 millimetre (0.012 inch) or less.

1635. Alloy steels, as follows:
(a) Containing:
(1) 10 per cent. or more molybdenum (but 5 per cent. or more molybdenum in any alloys containing more than 14 per cent. chromium); *or*
(2) 6 per cent. or more cobalt except:
(i) Permanent magnetic metals with a cobalt content of 25 per cent. or less;
(ii) High speed tool steels containing up to 10 per cent. cobalt, less than 5 per cent. chromium and no nickel;
NOTE: The Export Licensing Branch will consider licences for exports of small quantities of narrow strips for watch springs.
(iii) glass to metal sealing alloys or alloy steels containing 20 per cent. or less cobalt; *or*
(3) 1.5 per cent. or more niobium and/or tantalum;
(b) Nickel bearing stabilized steels, not elsewhere specified, having a total of 38 per cent. or more of alloying elements except such steels containing less than 0.4 per cent. titanium or niobium-tantalum;
NOTE: For the purpose of calculating the 38 per cent. cut-off, the maximum of the range specified for each element is to be taken. In the absence of a specified maximum for titanium or niobium-tantalum, the figure of 0.4 per cent. shall be used to indicate the presence of titanium or 0.8 per cent. for niobium-tantalum. The 38 per cent. cut-off must not be exceeded to take account of manufacturing or other tolerances. Alloying elements means all constituents other than iron.
(c) Precipitation hardening steels, containing 4 per cent. or more nickel.

1648. Cobalt, as follows:
(a) Raw materials, including White Alloys and Red Alloys;
(b) Cobalt metal and cobalt-bearing alloys (other than alloys covered by Items 1631 and 1635), containing:
(i) 50 per cent. or more cobalt; *or*
(ii) 19 per cent. or more cobalt and 14 per cent. or more chromium and less than 1 per cent. carbon; *or*
(iii) 19 per cent. or more cobalt and 14 per cent. or more chromium and 3 per cent. or more molybdenum;
NOTE: The Export Licensing Branch will consider licences for the export of small quantities of dental alloys and small quantities of narrow strips for watch springs.
(c) Scrap forms of the metal and alloys covered under (b) above.

1649. Niobium (columbium), as follows:
(a) Raw materials;
(b) Ferro-niobium and ferro-niobium-tantalum;
(c) Metal and niobium-based alloys containing 50 per cent. or more niobium or 60 per cent. or more niobium-tantalum in combination;
(d) Scrap forms of the metal and alloys covered under (c) above.

1654. Magnesium base alloys having a content of 0.4 per cent. or more of zirconium, or 1.5 per cent. or more of thorium, or 1 per cent. or more of rare earth metals (cerium mischmetal), as follows:
(a) Crude and semi-fabricated forms;
(b) Scrap forms.

1658. Molybdenum, as follows:
(a) Ferro-molybdenum;
(b) Metal and molybdenum-based alloys containing 50 per cent. or more molybdenum;

NOTES: 1. Sub-item (b) does not cover clean wire of a diameter not exceeding 500 microns and which, after having been fully annealed, has an elongation factor not exceeding 5 per cent. for diameters up to 200 microns and not exceeding 10 per cent for diameters of between 200 and 500 microns.
2. The Export Licensing Branch will consider applications for licences for the export of clean wire of a diameter not exceeding 1,000 microns and which, after having been fully annealed, has an elongation factor not exceeding 12 per cent.
(c) Tubing and platinum-clad tubing.

1661. Nickel, as follows:
(a) Raw materials;
(b) Nickel-base alloys (other than alloys covered by Items 1631 or 1635) containing 32 per cent. or more nickel, *except*:
(i) Nickel-copper alloys containing not more than 6 per cent. of other alloying elements;
(ii) Electrical resistance materials, as follows:
Wire, rod, tape and strip;
(iii) Bi-metallic strip for thermostats;
(iv) Thermocouple nickel-chrome wire containing less than 95 per cent. nickel and within a diameter range of 0.2 millimetre to 5 millimetres both inclusive;
(c) Scrap forms of the alloys covered under (b) above.
NOTE: It is not the intention to cover those magnetic materials not covered by Item 1631.
See also A.E.9, 10 and 11.

1668. Tungsten wire in any form, *except*:
(i) cut coil filaments;
(ii) uncoated wire of a thickness not exceeding 600 microns of which the tensile strength does not exceed 35 grams per milligram per 200 millimetres (140 kilogrammes per square millimetre);
(iii) thoriated tungsten wire which is *either* of a diameter of 1 millimetre or more containing by weight 2 per cent. or less thorium oxide which is cut in lengths not exceeding 30 centimetres for welding purposes, *or* of a diameter of 50 microns or less containing by weight 1 per cent. or less thorium oxide.
NOTES: 1. Tensile strength is measured after drawing wire to a diameter of 180 microns for wire of greater diameter after heating for 10 minutes in a hydrogen atmosphere at 2,100° Centigrade.
2. A coated wire is a wire covered with an electron emitting layer or with an insulating material.

1670. Tantalum, as follows:
(a) Raw materials;
(b) Ferro-tantalum and ferro-tantalum-niobium;
(c) Metal and tantalum-based alloys containing 60 per cent. or more tantalum or 60 per cent. or more tantalum-niobium in combination;
NOTE: The Export Licensing Branch will consider licences for exports of tantalum in surgical forms.
(d) Scrap forms of the metal and alloys covered under (c) above;
(e) Seamless pipe and tubing.

1671. Titanium, as follows:
(a) Metal and titanium-based alloys containing 70 per cent. or more titanium;
(b) Scrap forms of the metal and alloys covered under (a) above.

Plutonium, uranium and thorium. (See A.E.1.)
Zirconium. (See A.E.8.)
Beryllium. (See A.E.12.)
Lithium. (See A.E.35.)

Group K

Chemicals, Metalloids and Petroleum Products

1701. Detonating and priming compositions, as follows:
(a) Mercury fulminate, lead azide, lead styphnate, lead thiocyanate, lead dinitroresorcinate, barium styphnate tetrazine; and detonating or priming compositions (mixtures) containing one or more of these chemicals;
(b) Sodium azide.

1702. Hydraulic fluids, synthetic, having a viscosity of not more than 4,000 centistokes at −54° Centigrade and not less than 1.5 centistokes at +150° Centigrade.

1703. Stabilizers for explosives, as follows:
(a) Ethyl and methyl centralites;
(b) NN-diphenylurea (unsymmetrical diphenylurea);
(c) Methyl-NN-diphenylurea (methyl unsymmetrical diphenylurea);

(d) Ethyl-NN-diphenylurea (ethyl unsymmetrical diphenylurea);
(e) Ethyl phenyl urethane;
(f) Diphenyl urethane;
(g) Diortho tolyl-urethane;
(h) 2-Nitrodiphenylamine;
(i) p-Nitromethylaniline.

1715. Boron, the following:
(a) Boron minerals, including but not limited to Colemanite, Pandermite, Rasorite and Ulexite, crude and refined;
(b) Boron element (metal), all forms including grains and powder;
(c) Boron carbide and boron nitride;
(d) Boron compounds and mixtures, not elsewhere specified, the following:
  (i) Boric acids and salts (sodium, potassium, ammonium, magnesium and calcium) and esters of boric acids, crude or refined, not including perborates;
  (ii) Boric oxide, boron trifluoride and its complexes, boron trichloride and its complexes and fluoroborates;
  (iii) Other boron compounds (excluding metal borates, not elsewhere specified, and perborates), alloys or mixtures, containing 10 per cent. or more of boron in combined and/or elemental (metallic) form.

NOTE: The Export Licensing Branch will consider applications for licences, provided they are not made on a frequent and repetitive basis, for the export of quantities, not exceeding £1,400 ($4,000) of boron materials covered by sub-item (a) and (d) (i), or boric oxide covered by sub-item (d) (ii) or preparations normally used in enamelling and glassware covered by sub-item (d) (iii). In all cases Export Licensing Branch will need to be satisfied that the material will be used for the manufacture of products intended for civilian purposes.

1718. Tetrafluoroethylene, polymerized or not; and manufactures wholly thereof.
NOTE: The Export Licensing Branch will consider applications for the export of individual shipments containing up to 50 kilogrammes of tetrafluoroethylene in any form, as well as for larger quantities in fabricated forms which can be shown to have no strategic applications.

1721. Diethylene triamine.

1723. Trifluorochloroethylene, polymerized or not; and manufactures wholly thereof.
NOTE: The Export Licensing Branch will consider applications for the export of individual shipments containing up to 5 kilogrammes of trifluorochloroethylene in any form, as well as for larger quantities in fabricated forms which can be shown to have no strategic applications.

1731. Hydrazine in concentrations of 70 per cent. or more; hydrazine nitrate; unsymmetrical dimethyl hydrazine.

1732. Hydrogen peroxide (50 per cent. strength and over).

1741. Nitroguanidine.

1742. Guanidine nitrate.

1744. Pentaerythritol tetranitrate.

1748. Picric acid (trinitrophenol).

1755. Silicone fluids and greases, as follows:
(a) Halogenated silicone fluids;
(b) Lubricating greases capable of operating at temperatures of 180° Centigrade or higher and having a drop point of 220° Centigrade or higher.

1757. Silicon of a purity of 99.9 per cent. or more.

1760. Tantalum compounds.

1770. Any liquid fuel, including petroleum products, having a gross calorific value of not less than 13,000 calories/grammes (23,400 British Thermal Units per pound) which contains high energy components or compounds.

1781. Synthetic lubricating oils and greases (ester type) which are or contain:
(a) Esters of dibasic saturated aliphatic acids combined with saturated aliphatic monohydric alcohols; where both of the two constituents contain six or more carbon atoms; and/or
(b) Esters of dibasic saturated aliphatic acids combined with polyglycols, when one or both of the two constituents contain six or more carbon atoms;
(c) All fluoro-alcohol esters.
(d) All polyphenyl ethers containing more than 3 phenyl groups.

NOTE: *Excepted* from parts (a)-(d) above are:
Those oils and greases containing by weight either not less than 50 per cent. of neutral castor oil; or not less than 5 per cent. of neutral castor oil and not less than 50 per cent. of castor oil and petroleum oil together.

Fuming nitric acid. (See M.L.8.)
Deuterium and compounds. (See A.E.5.)
Fluorine. (See A.E.14.)
Chlorine trifluoride. (See A.E.15.)
Fluorinated hydrocarbons. (See A.E.17.)
Artificial graphite. (See A.E.34.)
Lithium compounds. (See A.E.35.)

Group L

Synthetic Rubber and Synthetic Film

1801. Synthetic rubber, the following:
(a) Alkyl polysulphide liquid polymers;
  NOTE: The definition is intended to cover polymers which are in themselves liquid. Water dispersions, otherwise called latices, are not covered.
(b) Fluorinated silicone rubber and other fluorinated elastomeric material and such organic intermediates for their production as contain 10 per cent. or more of combined fluorine.

1920. Synthetic film for dielectric use (condenser tissue) of 0.0015 inch (0.038 millimetre) or less in thickness capable of being used for condensers covered by the definition of Item 1560.

CHAPTER XX

SOURCE REFERENCES

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PART THREE

THE SOVIET UNION

CHAPTER I

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Section 7 - Geophysical and Core-Drilling Activities (Pages 69 - 71)

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