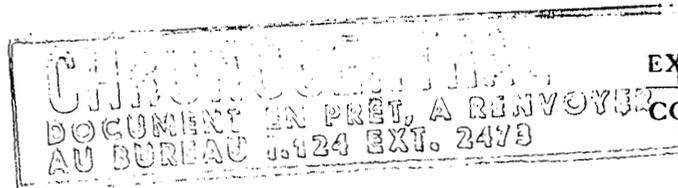


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N A T O R E S T R I C T E D

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AC/127-D/488

ECONOMIC COMMITTEE

THE SOVIET ENERGY INDUSTRY

PERFORMANCE AND PROSPECTS

Note by the French Delegation

Very satisfactory results

The Soviet Union is the world's leading coal producer and is second only to the United States in the production of oil, natural gas, electricity and nuclear energy(1). More than half the world's known energy reserves(2) occur in the Soviet Union while its population represents only 7% of mankind and accounts for only 18% of all the energy consumed in the world.

The Russians produce 12% more energy than they consume and export coal (40 million tons), oil (a quarter of total output or rather more than 100 million tons), natural gas and electricity. In addition to an up-to-date rail network of nearly 140,000 km, there is an internal network of 80,000 km of gas pipelines and 40,000 km of oil pipelines. This network extends beyond the frontiers of the Soviet Union and enables it to export oil and gas throughout Central Europe and even, as regards natural gas, to the FRG and soon to Italy and France as well.

Weak points

This apparently flourishing situation has a number of weak points for which the explanation is in part structural and in part political.

This document includes: 9 Annexes

- (1) 1973 output: Oil, 424 million tons; natural gas 238 milliard cu.m; coal, 635 million tons; electricity, 915 milliard KWHR, nuclear energy(installed capacity), 3,267 MW (9,000 in 1975).
- (2) 62% of the fossil fuel resources (expressed in coal equivalent tons or CET), i.e. 55% of the coal, 45% of the natural gas, 60% of the peat and 38% of the oil-bearing areas.

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Domestic requirements

It has become a common-place to say that European Russia accounts for four-fifths of Soviet economic requirements while four-fifths of the useable resources occur in Western and Central Siberia. But it is worth emphasizing that the eastward shift in the centre of gravity of the Soviet energy industry is an irreversible trend and that the opening up of Siberia is vital to the development of the Soviet economy and to the preservation of the Russians' hold over the European Communist countries.

As from 1975, Siberia will be producing 40% of all the energy used in the Soviet Union, as against 22.9% in 1965. After 1980(1) half of the oil produced in the Soviet Union will come from east of the Urals. This trend will increase and, in 1990, the 200 million inhabitants living west of the Urals (out of a total of 285 million for the whole of Russia) will get from Siberia 80% of all the energy consumed in the country.

This disproportion between the producer and consumer areas(2) gives rise to serious difficulties, especially where transport is concerned. The oil and gas deposits of Tyumen, the Kansk-Achinsk coal-mines and the rich Yakutsk coal and gas deposits occur in inhospitable regions where they are difficult to exploit. Furthermore, while European Russia west of the Urals has an excellent and comprehensive transport system (railways, waterways, oil pipelines and gas pipelines), the Siberian deposits are located thousands of kilometers from the consumer areas and, in the absence of a road network, can only be transported on the Trans-Siberian railway. At the time of writing (1974), there are only two oil pipelines linking Tyumen and Bashkir with European Russia, which means that Siberian crude product can flow through the "Druzhba" (Friendship) pipeline. The north of the Tyumen region will not be linked by a gas pipeline with European Russia until the end of this year.

Almost uninhabited and lacking communications, Siberia is slowly but surely becoming the focal point of the Soviet energy industry. The deposits in European Russia are being worked out while the demands of the economy and of the population are steadily growing.

External considerations

The Soviet Union is determined to preserve its hold on the COMECON countries(3) by means of its virtual monopoly in the supply of power. All the "satellite" countries except Rumania are more than 80% dependent on the oil supplied by Russia through

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- (1) A quarter as from 1975.
 - (2) See map of the Soviet Union in 1975.
 - (3) Council for Mutual Economic Aid.

the pipelines it controls. As the international gas pipelines near completion, this is also becoming true of natural gas. The MIR international system of electrical interconnections enables the Soviet Union, the main supplier, to control the distribution of electrical power in each of the countries concerned. Hungary and Bulgaria, and to a lesser extent Czechoslovakia, depend on the Soviet Union for their coal. The nuclear power stations, which are all in their early stages are closely controlled by the Soviet Union, which receives and enriches their uranium output. The Russians attach great importance to maintaining their energy monopoly, which provides them with a powerful political lever within COMECON, the monolithic Central European grouping.

Moscow also seeks to maintain a big flow of exports to the Free World, which is rich in hard currency and the technical facilities necessary for harnessing and transporting Siberia's natural resources.

The options

The energy policy of the Soviet Union is therefore designed to take account of the domestic imbalance and promote Soviet aims in Central Europe and the Free World.

In formulating their energy policy, the Russians have sought to compare the cost (including investments) of extracting and ferrying fuel for European Russia(1) with the combined extraction and transport costs, based on distance, of all the types of fuel which can be obtained from Siberia (oil, natural gas, coal)(2).

The comparison has revealed that it is in all respects a paying proposition to move natural gas and oil from Tyumen to European Russia, since it works out at half the price of coal from the Donbas or the Kuznetsk basin. The best solution would be to move Tyumen and Central Asian gas through the largest possible diameter pipes, transport costs can be cut by 20% if 1,420 mm pipes are used instead of 1,020 mm. The use of 2,520 mm high-pressure pipes results in a saving of one-third by comparison with 1,420 mm pipes and 50% by comparison with 1,020 mm pipes. However, these conclusions require some qualification:

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- (1) For fuel extraction and transport costs based on type and destination, see Tables 2, 3, 4 and 5.
 - (2) See Tables 2, 3, 4 and 5.

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- a large part of the oil extracted in Siberia will be used on the spot, in Siberia, Kazakhstan and the Far East;
- the amount of Tyumen oil which can be piped to European Russia may be insufficient to cover this area's energy gap;
- in some cases, low-cost open-cast coal mining can compete with natural gas if the coal has only to be transported over short distances; thus, coal from Ekibastuz is just as economical as Tyumen natural gas for providing electrical power to the Ural region; on the other hand it is better to use on the spot coal from Kansk-Achinsk (open-cast), whose price doubles when it is transported 350 km and for which the transport costs, over a distance of 3,000 kms, are 7 to 8 times higher than the cost of extraction.

Short-term policy
(1971-1975)

Basically, this policy, which will be continued until the end of 1975, may be summarized as follows:

- a sharp increase in the proportion of oil and gas in the fuel pattern(1), since nuclear energy is only able to cope with peak electrical consumption in European Russia(2);
- bridging European Russia's energy gap by stepping up the supplies of oil and natural gas from Siberia even if this is not always the most economic solution;

-
- (1) In 1975, oil and gas will together make up 67% of the fuel pattern. This total is in line with the Plan but the ratio of oil to gas is far higher than provided for in the forecasts. An undervaluation of oil requirements has been aggravated by insufficient growth in gas output. All this has led to over-consumption of petroleum products which ought to have been replaced by gas; oil consumption was four times that of gas in 1960 and only twice that of gas in 1966, but there has been no change since that year although 1980 is the target date for putting them on an equal footing. See Annexes A, B, C, D, F, G and H concerning oil and natural gas.
 - (2) There is only one small power station (Bilibino) East of the Urals (in the KAMCHATKA Region). All the present and planned power stations are West of the Urals. For a map of the nuclear power stations see Table 1 in Annex 1.

- expansion of the oil pipeline system, which was soft-pedalled during the 8th Plan in favour of gas pipelines, and extension of the gas pipeline network with use of high pressures in large diameter pipes (see map of oil and gas pipelines);
- efforts will be made to locate factories which are big consumers of energy (chemical and aluminium plants) near the Siberian deposits so as to make operations cost-effective and promote settlement in these areas;
- the doubling of energy supplies to the COMECON countries(1), to meet their requirements and preserve the Soviet hold over them; (see the Druzhiba maps, transport of oil and gas in Europe);
- stepping up of exchanges with the industrialised countries of Europe, America and the Far East, with a view to obtaining the necessary technological assistance.

Medium-term policy
(1980)

With natural reserves of energy guaranteed for many years to come, the Soviet Union would seem to be in a position to pursue, at least until 1980, the energy policy outlined in the 9th Plan, i.e. modification of the fuel pattern and bridging of the energy gap in Europe through the harnessing of Siberian resources(2) and preservation of ascendancy over the COMECON countries. However, only by pursuing and expanding its barter transactions with the Free World will Moscow be able to instal the Infrastructure necessary to develop the Siberian energy resources which represent the key to its economic and therefore political future. In line with its centralizing policy, the Soviet Government will develop a "uniform energy system" covering the areas lying between Lake Baikal and the Western frontiers of the country. This system will seek to make the most economical use of all energy sources East and West of the Urals.

Until 1976 at least, the Soviet Union will maintain its old prices for oil deliveries to the COMECON countries(3). According to the forecasts for the 10th Plan (1976-1980) Czechoslovakia, for instance, will receive 24 million tons

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- (1) Oil deliveries to the COMECON countries amounted to 135 million tons during the 8th Plan and 256 million tons during the 9th Plan.
 - (2) See map of the USSR 1975.
 - (3) Two dollars a barrel (159 litres) delivered through the Druzhiba; this is well below the new world prices.

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from Russia in 1980 as against 15.5 million tons in 1975. Similarly, yearly deliveries to Hungary, which amounted to an average of 5 million tons during the period of the 8th Plan, will rise to between 8 and 10 million tons under the 10th Plan. By virtue of the existing contracts, Hungary, Bulgaria and Czechoslovakia will get between 65% and 90% of the natural gas they require from the Soviet Union in 1980.

With regard to the non-Soviet world, Moscow will stick to its political-economic policy of promoting and expanding the barter transactions which were started with Europe in 1969 and have proved so successful, especially where natural gas is concerned (raw materials in exchange for technical and financial assistance in their extraction and transport).

The efforts made over the last two years to associate the United States and Japan with the opening up of Siberia will be continued. The Soviet Union will have to obtain most-favoured-nation status to get the United States agreement to the exploitation of Tyumen natural gas and its transport, via Murmansk, to American ports (this is strongly backed by American firms).

It will also be necessary to overcome the reluctance of Japan which, in spite of the enticement of coal and gas from Yakutsk and oil from Tyumen, remains wary of becoming deeply involved in the Siberian venture (projects worth 8 milliard dollars). The Japanese Government has no wish to upset an enormous potential customer like China for whom the opening up of Siberia (Irkutsk Nakhodka pipeline or Northern Trans-Siberian) represents a further threat to its frontiers(1).

The conclusion of these agreements would allow the Soviet Union to become a major world exporter of natural gas. It would permit an increase in domestic consumption of petroleum products leading to a higher standard of living and the advent of the motorized society. At present, domestic consumption is limited by the need to meet the growing demands of the COMECON countries and to sell sizeable quantities (approximately 50 million tons a year since 1969) of oil products at the full price to the energy-importing Western countries which possess the necessary hard currency and the technical facilities for extracting and transporting raw materials.

The optimism shown by the Soviet leaders on the energy question is probably justified. There is no doubt that they are confident in their oil policy since they are building up a powerful fleet of merchant-men: for the past two years, a

(1) On 22nd April, however, Japan signed a preliminary agreement covering 1 milliard dollars (coal and gas from Yakutsk).

150,000 ton tanker has been launched in the Soviet Union each year. A 370,000 ton super-tanker is on the stocks. Similarly, the Soviet Union has not hesitated to enter into 20-year contracts for the export of gas to the FRG, Finland, Italy and (soon) France.

It is also worth bearing in mind that the resources of the Soviet Union allow it to maintain the most powerful army in the world which, because of its vast number of armoured vehicles and high degree of mechanization, is a major consumer of energy. The Soviet Navy is the world's second largest and the average age of its warships is lower than in any other Navy. It keeps large reserves of military fuel in Central Europe(1) and on the Chinese frontier, particularly in Outer Mongolia.

One striking paradox of Soviet oil policy is that because of a general policy which still takes little account of cost-effectiveness, success in certain categories is achieved at the expense of other sectors.

This is a country where everyday articles from wind-screen wipers to saucepans are hard to obtain and of very poor quality and where spare-parts of virtually any description are in short supply, while at the same time Soviet space vehicles roll across the moon, observation satellites leave nothing to be desired (as shown during the Yom Kippur War) and the most advanced weapon systems (strategic vectors, MIRVs, nuclear submarines, warships, armoured and mechanized equipment) are on a par with anything the West has to offer.

The same contradictions are found in the energy field where rational options based on extraction and transport costs come up against heavy-handed bureaucracy, poor management and a slavish attachment to regulations, all of which are leftovers from the Czarist regime made worse by the existing totalitarian system.

This explains the underevaluation of domestic oil requirements, the slow development of the gas industry and the difficulties encountered in setting up energy-consuming industries at the place of production in Siberia. In this connection, reference should be made to the attitude of civil servants who are reluctant to release building credits (the costs are higher than in European Russia because of the inhospitable climate) for a complex of factories in Siberia which in the medium-term would mean a big saving in energy transport costs but which in the short-term cannot be squared with the annual budget. At all levels, people are judged by the step-by-step results of the Plan and not overall.

(1) 6 weeks' fighting for 80 divisions and 4,000 tactical aircraft

All the same, the Soviet energy industry has no lack of competent engineers at managerial level and the work force is no worse than elsewhere. But the system itself and the over-rapid organizational development have prevented the formation of an adequate body of middle-range staff (foremen, assistant engineers, craftsmen and highly skilled workers) like that existing in the old-established Western countries.

These basic executive weaknesses are coupled with technocratic blunders. But they should not prevent the ultimate success of the "Soviet gamble" on which the economic future of the country depends. The energy reserves of the Soviet Union provide the guarantee that the future will be assured for a very long time. In the short and medium-terms, it seems possible that the policy pursued by the Soviet Union will enable it to meet energy requirements at the end of the transitional 9th Plan period, the only weak spot being the slow rate of development of natural gas production. The "compelling need" to open up Siberia, and the technological assistance that this will require from the industrialized countries, will be the chief consideration of the Soviet Union until at least 1980. The major part which the United States and Japan seem willing to play on the Siberian market should be decisive in this respect.

The full effects of the intensive working of the Siberian deposits is hardly likely to have its full impact on the overall Soviet economy before 1985. It seems that the Soviet citizen will have to wait until the end of the century for the advent of the consumer society in the concrete form of private vehicle ownership.

The maintenance of a certain degree of international stability, which will enable the Soviet Union to devote its efforts, investments and human and material resources to the promotion of this energy policy will be a determining factor in the economic future of this great power in the post-industrial era. It will be necessary to wait until 1985 to judge whether these efforts have succeeded - but there is a good chance that they will.

MAIN CRUDE OIL PRODUCERS

(1972 figures, in millions of tons)

COUNTRY	OUTPUT	%
United States	527.4 (470 in 1971)	25
USSR	394.0 (424 in 1973)	18
Saudi Arabia	285.9	13.5
Iran	252.3	12
Venezuela	168.2	8
Kuwait	151.0	7.5
Nigeria	89.7	4.5
Canada	86.4	4.5
Iraq	70.2	3.5
Indonesia	53.7	2.5
<u>TOTAL</u>	<u>2,078.8</u>	<u>100%</u>

INVENTORY OF PROVEN OIL RESERVES

(in millions of tons, beginning of 1973(1))

COUNTRY	RESERVES	% OF WORLD RESERVES
Saudi Arabia	23,000	26
USSR	10,500	12.5
Kuwait	10,300	12.5
Iran	8,700	10
United States	5,300	7
Iraq	5,000	6
Libya	3,500	4.5
China	2,800	3
Abu Dhabi	2,000	2.5
Venezuela	2,000	2.5
Algeria	1,750	2
Canada	1,200	1.5
Indonesia	1,200	1.5
Miscellaneous	6,000	8.5
<u>TOTAL</u>	<u>83,250</u>	<u>100%</u>

(1) The figures are only estimates since the concepts of proven, certain, probable and estimated reserves can be interpreted in different ways

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SOVIET OIL EXPORTS

Exports to the Communist Countries
(in thousands of tons)

	<u>1970</u>	<u>1971</u>	<u>1972</u>
Czechoslovakia	10,466	11,810	12,866
GDR	9,342	10,378	11,480
Poland	8,142	9,550	11,066
Bulgaria	7,050	7,959	7,949
Cuba	5,987	6,444	7,025
Hungary	4,759	5,055	5,529
Yugoslavia	2,740	2,880	3,398
North Korea	838	699	398
North Vietnam	353	375	192
Mongolia	260	267	297
TOTAL	<u>49,937</u>	<u>55,417</u>	<u>60,200</u>

Exports to the Free World

	<u>1969</u>	<u>1970</u>	<u>1971</u>	<u>1972</u>
(Italy	10,735	10,194	9,002	8,430
(Finland	8,083	6,223	8,567	8,627
(FRG	5,801	6,300	6,092	6,195
(Sweden	4,678	4,818	4,569	4,363
(France	2,656	2,549	4,539	3,078
Europe (Belgium	758	1,275	2,038	2,516
(Austria	668	1,053	1,128	767
(Denmark	534	377	861	772
(Switzerland	539	445	805	822
(Holland	-	1,444	1,631	2,433

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		<u>1969</u>	<u>1970</u>	<u>1971</u>	<u>1972</u>
Other	(Japan	2,201	2,713	2,284	1,011
Countries	(Egypt	1,019	1,639	1,604	1,442
of the	(Greece	850	928	1,011	909
Free and	(Morocco	633	699	868	934
Third	(Ghana	540	515	598	625
World	(India	488	252	473	378(1)
	(Miscellaneous	<u>3,040</u>	<u>1,886</u>	<u>2,985</u>	<u>1,828</u>
	<u>TOTAL</u>	43,223	43,310	49,055	45,130

(1) This figure should be multiplied tenfold for 1974 since, during Mr. Brezhnev's recent visit to India, an agreement was signed for 1974 covering the delivery of 4.5 million tons of oil, including 1.5 million tons of refined product.

Proportion of Oil and Gas in the
Soviet Fuel Pattern
(as a percentage)

Year	Oil	Gas	Oil + Gas	Oil by comparison with Gas
1960	30.5	7.9	38.4	80
1961	32.4	9.7	42.1	76
1962	34.2	10.9	45.1	75
1963	34.8	12.4	47.2	73
1964	35.1	13.9	49.0	71
1965	35.8	15.5	51.3	69
1966	36.7	16.5	53.2	68
1967	37.8	17.4	55.2	68
1968	39.3	17.9	57.2	68
1969	39.9	18.7	58.6	68
1970	(plan)(37.9) achieved 41.1	(18.9) 19.1	(56.8) 60.2	(66) 68
1971	41.8	19.5	61.3	68
1975	(plan)(43)	(22.1)	(65)	(66)
1980	(plan)(37.7)	(30.9)	(68.6)	(54)

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VOLUME AND PERCENTAGE OF OIL IMPORTS BY THE SOCIALIST
COUNTRIES FROM THE USSR AND THE MIDDLE EAST

	Production	Total imports	Imports from USSR	% of total imports	Imports from Middle East	Percentage of total imports
FRG						
1970	60,000 tons	10.3 m.t. (1)	9.2 m.t.	90%	Iraq, Egypt 1.1 m.t. in 1971	10%
1975	60,000 tons	18 m.t.	16 m.t.	90%	Iraq, Egypt Saudi Arabia 2 (?)	10%
POLAND						
1970	430,000 tons	8 m.t.	7 m.t.	90%	Syria, UAR 1 ditto + BP +	10%
1975	1.4 m.t. (forecast but unreal- izable: 370,000 tons 1973)	18 m.t.	14 m.t.	80%	Iran 1 + 3	20%

(1) m.t. = million tons

	Production	Total imports	Imports from USSR	% of total imports	Imports from Middle East	Percentage of total imports
CZECHOSLOVAKIA						
1970	210,000 tons	9.7 m.t.	9.4 m.t.	95%	Iran 0.3	5%
1975	210,000 tons	18 m.t.	15.5 m.t.	85%	Iran, Iraq, Venezuela (refined) 2.5	15%
	probably less (195,000 tons in 1972)					
BULGARIA						
1970	338,000 tons	5.6 m.t.	4.7 m.t.	90%	Algeria, UAR 1	10%
1975	338,000 tons	12 m.t.	10 m.t.	90%	Lebanon + Iraq	10%
	or less: 248,000 tons in 1972				Iran, Libya 2	
HUNGARY						
1970	2 m.t.	4.3 m.t.	4 m.t.	80%	Iraq, Syria 0.2	20%
1975	2.4 m.t.	10 m.t.	6.5 m.t.	65%	Iraq, Syria 3.5	35%
1980	(plan) (possible)		10 m.t.			
ROMANIA						
1970	13.3 m.t.	Refined 15 million tons in 1970; consumed 8 million tons; imported 2 million tons from Iran; 2.4 million tons in 1973, then 5 million tons per annum from 1975				
1975	14.3 m.t.					

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	Production	Total imports	Imports from USSR	% of total imports	Imports from Middle East	Percentage of total imports
YUGOSLAVIA						
1970	2.8 m.t. (consumed 7 m.t. in 1970 and 12 m.t. in 1975)	4.9 m.t.	2.7 m.t.	50%	1970 2 m.t. incl. 550,000 tons Iran and 600,000 tons Iraq	80%
1975	4.5 in 1975 (doubtful)	7.5 m.t.	3.5 m.t.	50%	3 m.t. from Iran, Iraq, Libya (1 m.t. per annum)	40%
1980	6.5(?)	16(?)m.t.	4(?)m.t.	25%	12(?) Iraq- Iran	75%(?)

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EXPORTS OF NEAR AND MIDDLE EAST OIL TO THE SOCIALIST
COUNTRIES (INCLUDING YUGOSLAVIA)

- 1970: 8 million tons
 - 1975: 23 million tons
 - 1980: 40 million tons
- } (forecast)

Origin of oil: Iran, Iraq, Syria, Libya, Egypt

Importers in 1975:

GDR	2 million tons	(probable figure)
Poland	4 million tons	(probable figure)
Czechoslovakia	3 million tons	(probable figure)
Bulgaria	2 million tons	(probable figure)
Hungary	3.5 million tons	(probable figure)
Rumania	5 million tons	(probable figure)
Yugoslavia	3.5 million tons	(probable figure)

Soviet production - imports - exports - natural gas
in milliards of cubic metres

	1972	1975	1980 (Forecasts)	2,000 (Forecasts)
Production	221	300	680	1,500
Imports	Iran 6.0 Afghanistan <u>2.5</u> Total 8.5	Iran 10 Afghanistan <u>4</u> Total 14	Iran 10 Afghanistan <u>4</u> Total 14	(Up to 1985, contract renewable for ten years). Up to 1985 (58 in all).
Exports	GDR 0 Poland 1.5 Hungary 0 COMECON Bulgaria 0 Czechoslovakia 1.7 Rumania <u>0</u> Total 3.2	1.0 2.0 1.5 1.0 3.5 <u>0</u> 9.0	7 2.0 5 5 7 <u>0</u> 26.0	
The West	Austria 1.5 France (Methane) 0.4 Total 1.9	Austria 1.5 FRG 3 Italy 6 Finland (1976) 1.4 France <u>2.5</u> Total 14.4	(Increased to six a year, 120 milliard in 20 years up to 1993) (100 milliard in 20 years) (then 3 up to 1993) (for 20 years) Total 19.0	
United States and Japan Total	0 <u>5.1</u>	0 <u>23.4</u>	Total 40(?) <u>85(?)</u>	
Export Balance Sheet	-3.4	+9.4	+70(?)	

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Imports of Soviet natural gas by the COMECON countries
(in milliards of cubic metres)

Country	1972	1975 (forecasts)	Production		Imports as a percentage of overall requirements	
			1972	1975	1972(1)	1975(1)
GDR	0	1.0 (7 in 1980)	4.7	12	0	10 (40 in 1980)
Poland	1.0	2.0 (2.0 ")	5.8	8	20	20 (20 ")
Hungary	0	1.5 (5 ")	3.0	3.0	0	50 (65 ")
Bulgaria	0	1.0 (5 ")	0.0	0.5	0	70 (80 ")
Czechoslovakia	1.7	3.5 (7 ")	0.5	0.8	80	80 (90 ")
Rumania	0	0 (0 ")	22.2	25.0	0	0 (0 ")
TOTAL	2.7	9.0 (26 in 1980)	36.2	49.3		

(1) In 1972, only Poland and Czechoslovakia were linked with the Soviet Union by gas pipeline.
In 1975, three more countries will be so linked (GDR, 1973, Hungary end-1974, Bulgaria, 1975).

ELECTRICAL ENERGY UNDER THE NINTH PLAN

Of the 290-330 milliard kilowatt hours of generating power to be created under the Ninth Plan, 263 will be produced by thermal generation. The 41 milliard kilowatt hours produced by hydro-stations will be generated mainly in Siberia and in Central Asia.

Comparison of output in 1970 and 1975 by type of station

Type of station	1 9 7 0		1 9 7 5		% 1975 compared with 1970
	Milliard kwh	%	Milliard kwh	%	
Total	740.0	100	1,065.0	100	143.9
Thermal stations	615.8	83.2	900.0	84.5	146.0
Hydro-stations	124.2	16.8	165.0	15.5	133.1

This Table shows that in 1975, just as in 1970, almost four-fifths of electrical energy will be generated by thermal stations. The increase in installed power (65-67 million kilowatts) will be provided mainly by extremely powerful stations(1). During the period of the Ninth Plan, 19 condensation thermal stations will be built generating 2.4 million kilowatts, 3.6 and 4 million kilowatts (as compared with 2.3 kilowatts-2.4 kilowatts under the Eighth Plan). The Krasnoyarsk hydro-station, commissioned in 1971 has a capacity of 6 million kilowatts (in the USA, where installed power is twice as great as in the USSR, only 3 stations have a capacity of more than 2 million kilowatts). The number of hydro-stations with a capacity in excess of 1 million kilowatts will total 11 in 1971, as compared with 6 in 1970. Thermal stations with the capacity of 1 million kilowatts or more will represent 45% of installed power in 1975. New thermal stations will in toto account for 70% of installed power in 1975 (12% for new nuclear stations; 18.5% for new hydro-stations).

(1) The use of 500 MW generators instead of 300 MW generators will mean a 5% saving in investment costs and a 9% saving in plant costs. With 800 MW generators savings can reach 7% and 9-10% respectively

TABLE 1

TRENDS IN THE PATTERN OF ELECTRICITY REQUIREMENTS

CONSUMER CATEGORY	1970		1975		1975 % in relation to 1970
	Milliard KWH	%	Milliard KWH	%	
Industry and building	452.6	72.3	622.5	69.3	137.5
Transport	55.2	8.8	75.5	8.4	136.5
Agriculture (including the domestic requirements of the rural population)	38.0	6.1	75.0	8.4	197.5
Requirements of towns and their urban population	80.0	12.8	125.0	13.9	156.5
TOTAL	625.8	100 %	898.0	100 %	143 %

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TABLE 2

COST OF FUEL EXTRACTION

(Project data expressed in roubles per CET)

	Investment Expenditure	Cost Price	Investment Expenditure
GROUP I			
Ekibastuz coal	8,9	1,3	2,7
Kansk-Achinsk coal	6,2	1,0	1,8
Tyumen natural gas	10,0	0,9	2,2
Central Asian natural gas	25,0	1,3	5,4
GROUP II			
Tyumen oil	24,8	2,4	6,2
Mangishlak oil	31,7	3,1	8,3
Kuznetsk coal (open cast)	19,2	3,8	6,6
Minusinsk coal (open cast)	19,7	4,7	7,7
GROUP III			
Kuznetsk coal (deep mined)	30,8	6,8	11,5
Karaganda coal	30,5	7,6	12,3
Donetsk coal	47,5	8,1	15,3
Vargashorsk coal (Peshora basin)	35,3	7,8	13,1
Estonian shale	25,8	7,7	11,6
Peat	39,7	5,7	11,6
GROUP IV			
Moscow coal	62,7	13,8	23,0
Kizyl (Tuva) coal	48,3	12,0	18,5
Lenger (Kazakhstan) coal	47,0	16,4	23,4
Kirghiz coal	53,5	13,0	21,1

TABLE 3
COMPARISON OF TRANSPORT COSTS FOR THE DIFFERENT FUELS
(Project data expressed in roubles per CET)

FUEL	Means of transport (type and specifications)	Transport over 1,000 KM			Transport over 2,000 KM		
		Invest- ment expend- iture	Cost Price	Budgeted expend- iture	Invest- ment expend- iture	Cost Price	Budgeted expend- iture
Oil	Pipeline 1020 mm	1,3	0,17	0,44	3,6	0,34	0,38
Natural gas	Gas pipeline 1020 mm	11,9	0,85	2,63	23,9	1,69	5,27
Natural gas	Gas pipeline 1220 mm	10,0	0,80	2,31	20,0	1,58	4,58
Natural gas	Gas pipeline 1420 mm	9,5	0,75	2,18	19,0	1,48	4,33
Natural gas	Gas pipeline 2020 mm	6,7	0,57	1,53	13,5	1,14	3,17
Natural gas	Gas pipeline 2520 mm	5,8	0,53	1,40	11,5	1,05	2,78
Kuznetsk coal	Main line electrified railways	10,4	1,69	3,23	20,4	3,19	6,22
Ekibastuz coal	" "	13,4	2,21	4,23	26,6	4,18	8,16
Knsk-Achinsk coal	" "	17,1	2,81	5,37	33,8	5,31	10,37

TABLE 4

COMPARISON OF EXPENDITURES AS REPRESENTED BY THE
EXTRACTION AND TRANSPORT OF DIFFERENT FUELS
FOR CONSUMPTION IN EUROPEAN RUSSIA

(In roubles for 1 CET)

Destination areas in European Russia	Donetz coal	Kuznetsk open cast coal	Tyumen gas	Asian gas	Fuel Oil	Peat
Leningrad	20,3	17,3	10,8	-	9,4	-
Moscow	18,4	16,1	10,0	13,3	8,1	11,6
Minsk	18,6	-	11,4	-	9,3	10,2
Gorki	18,8	15,0	10,0	-	7,7	-
Saratov	17,5	15,2	13,3	10,4	7,3	-
Donetsk	15,6	-	-	12,9	10,8	-

TABLE 5
COMBINED EXTRACTION AND TRANSPORTATION COSTS
BY TYPE OF FUEL AND DISTANCE COVERED
(In roubles for 1 CET)

Type of fuel	Extraction Costs	For transportation over 1,000 km			For transportation over 2,000 km			For transportation over 3,000 km		
		Trans. exp. (1)	Extrac. and trans. exp.	% Trans. exp.	Trans. exp. (1)	Extrac. and trans. exp.	% trans. exp.	Trans. exp. (1)	Extrac. and trans. exp.	% Trans. exp.
Tyumen gas	2.2	2.2- 1.4	4.4- 3.6	50- 39	4.3- 4.8	6.5- 5.0	66- 56	6.5- 4.2	8.7- 6.4	75- 66
Central Asian gas	5.4	2.2	7.6	29	4.3	9.7	44	6.5	11.9	55
Tyumen oil	6.2	0.4	6.6	6	0.88	7.08	12	1.3	7.5	17
Mangyshlak oil	8.3	0.6	8.9	7	1.1	9.4	12	1.6	9.9	16
Kuznetsk coal (open cast)	6.6	3.2	9.8	33	6.2	12.8	48	9.2	15.8	58
Ekibastuz coal	2.7	4.2	6.9	61	8.2	10.9	75	12.1	14.8	82
Kansk-Achinsk coal	1.8	5.4	7.2	75	10.4	12.2	85	15.4	17.2	90

(1) The first figure of the first line is for transport by 1420 mm gas pipeline
The second figure of the first line is for transport by 2520 mm gas pipeline.