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ENERGY PRODUCTION, POTENTIAL AND TRADE IN THE USSR AND EASTERN EUROPE: OUTLOOK FOR THE 1980s

Note by the Secretary General

The Council is invited to take note of this document which describes the present energy situation in the Soviet Union and the Peoples' Democracies as well as the outlook for the 1980s.

2. The report was prepared by the Economic Committee from contributions sent in by national authorities and from information provided at a meeting with experts.

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This document includes: 6 Annexes

N A T O C O N F I D E N T I A L

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IN THE USSR AND EASTERN EUROPE:
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CONTENTS

ANNEX IV: The Energy Balance in COMECON: Tables 1 to 3

ANNEX V: East European Energy Dependence

ANNEX VI: USSR Nuclear Power Plant Locations: Map 1

Principal Oilfields and Oil Pipelines in the USSR - Western Regions: Map 2(A)

Principal Oilfields and Oil Pipelines in the USSR - Eastern Regions: Map 2(B)

Principal Gasfields and Gas Pipelines in the USSR - Western Regions: Map 3(A)

Principal Gasfields and Gas Pipelines in the USSR - Eastern Regions: Map 3(B)

ENERGY PRODUCTION, POTENTIAL, AND TRADE IN THE USSR AND EASTERN EUROPE: OUTLOOK FOR THE 1980s

Report by the Economic Committee

A. THE SOVIET AND EAST EUROPEAN ENERGY SITUATION THROUGH 1985: AN OVERVIEW

1. Adequate energy resources are vital for the USSR in at least three respects: as necessary ingredients for increasing industrial output; as valuable commodities in international trade; and collectively as an essential strategic element in military strength. Moreover, through its trade in energy resources, the Soviet Union may be able to obtain political leverage in nations where the resources are scarce.

2. The outlook for energy in the USSR in the mid-1980s is one of critical supplies, especially of oil, and growing industrial demands. The USSR will probably be able, however, to produce adequate energy to ensure some economic growth and the continued provision of a major share of CMEA energy needs.

3. Oil production, the rate of growth of which is starting to decline, will face increasing constraints as Samotlor reserves become depleted and difficulties are encountered in developing new fields, principally in Siberia. The USSR's level of oil output in the 1980s will depend on the quality and speed of development of new reserves, and on the availability of necessary technology; merely to maintain present production levels, however, the USSR will have to allocate enormous capital investments to the oil industry. In the worst case it may have to import 15 million tonnes of crude petroleum annually, at a cost of nearly $5 billion a year, in 1985 dollars.

4. In the event, however unlikely, that the USSR is able to exploit alternative reserves, and is successful in implementing stringent domestic energy conservation measures over the next five years, it may be able to continue shipping at least 20 million tonnes or approximately one-third of its present level of oil exports to the West at increasing prices. Hard currency receipts for oil at present amount to some $6 billion annually, or roughly one-half of the USSR's convertible currency earnings from commodity trade. In any case, the USSR will probably be unwilling to commit itself to providing for petroleum deliveries to Eastern Europe, substantially above current levels.

5. Natural gas production will continue to increase dramatically, with the full development of Tyumen and other extensive reserves, so as to provide a partial substitute for domestic petroleum-based energy and that of the East European CMEA nations. Deliveries of natural gas to Eastern Europe might double in 1981-1985 over those of the previous five year period. Potential export of natural gas to the West, however, will not take the place of oil as a hard currency earner: at best, it may bring in some $4 billion annually.

6. Soviet coal production will continue to expand at only a very moderate pace, and increasing output of electricity will depend primarily on development of nuclear power installations, now proceeding much behind schedule. Probably only around 80% of planned nuclear capacity planned for completion by 1980 will actually be functioning then. Nonetheless, Soviet deliveries of nuclear power to Eastern Europe should double in the next five year period, and nuclear energy could account for 10%-12% of the USSR's electricity output by 1985. The USSR and Eastern Europe will continue to put heavy emphasis on the development of nuclear energy, for which they have ample uranium reserves.

7. The implications of these developments, whether at best or at worst, for the Alliance are that: (a) the East European nations in particular may become stronger competitors with the West for oil on world markets; (b) the USSR's economic growth and convertible currency earnings could be adversely affected by increases of oil production to meet rising domestic and foreign demands; (c) a decline in hard currency earnings, furthermore, would restrain Soviet imports of Western technology needed to promote desired economic growth and to assist in the more rapid development of energy resources; (d) in the final analysis, however, the USSR can probably make the necessary economic adjustments which energy scarcities might entail, without arousing unacceptable popular discontent.

B. ENERGY PRODUCTION IN THE USSR

(a) Current Levels and Sources

8. The USSR currently produces enough primary energy materials and electricity to meet its own needs, with certain quantities left over for export, mainly to Eastern Europe and to the industrial West. The USSR's primary energy export is oil and oil products, which take around 30% of domestic oil production and earn one-half of its receipts from commodity sales for convertible currency, or about one-third of its total convertible currency earnings when services, gold sales and arms supplies are taken into account.

9. In 1978 the USSR continued to be the world's leading producer of crude oil, closely followed by Saudi Arabia, and accounted for around one-fifth of total world production. After the United States, the USSR is the second largest producer of natural gas, extracting about one-fourth of the world total. Along with the United States, the USSR is one of the two leading producers of coal, each country accounting for about one-fifth of total world output.

10. Planned and actual production and trade of principal energy sources in the USSR in 1975-1978 are shown at Annex I, Table 1. Petroleum and petroleum products are the principal forms of primary energy, accounting for 45% in terms of Standard Fuel Equivalents (SFE)(1), of all primary energy produced in the USSR in 1978. The other most important primary energy sources are coal and natural gas, contributing 27% and 24% of primary energy, respectively.

11. About one-third of all the USSR's extracted primary energy materials are used in the generation of thermal electrical energy, itself a secondary energy source. Hydroelectric and nuclear electric power presently each account for only around 1% of all primary energy production in terms of SFE. The USSR produces around 5,000 tonnes of uranium yearly, or about 14% of total world output.

(b) Reserves and Anticipated Future Production Levels

12. Soviet reserves of primary energy resources - oil, gas and coal - are extensive. The USSR's known, recoverable reserves of petroleum are estimated by most Western observers to be somewhere between 7 and 10 billion tonnes, or around one-tenth of proved world reserves; they are as much as twice US reserves and at best one-half of Saudi Arabia's reserves(2). At least two billion tonnes of proven Soviet reserves are centred in the huge Samotlor oilfield in the West Siberian basin, which provides roughly 25% of current oil production, but which may become one-half to three-fourths depleted in the 1980-1985 period.

(1) Standard Fuel Equivalent (SFE): a concept derived from the calorific content of different fuels permitting comparison between them, or their summation, in terms of energy content.

(2) The CIA estimates proven Soviet petroleum reserves at only 4.5 billion tonnes. A private estimate recently released by the so-called "Petro Studies" in Malmo, Sweden, however, and allegedly based on a two year analysis of all relevant Soviet data covering a 20 year period, puts Soviet proven oil reserves at over 20 billion tonnes, claiming that the USSR has consistently downplayed additions to its proven oil reserves since 1961.

13. To make up for eventual declines in production at Samotlor and other older oilfields, the Soviets will have to rapidly develop production of other reserves, of which as much as some 60% are located in Siberia. Plans call for West Siberia to produce 310-315 million tonnes in 1980, more than half the year's goal of 606 million tonnes for the USSR as a whole. Additional reserves may be discovered with the full exploration of some 10-12 million sq.km of potential oil-producing area, including offshore deposits, which all together represent 37% of the world's sedimentary surfaces.

14. Because of climatic and transport difficulties in developing production in Siberia, however, as well as lags in exploratory drilling, it is questionable whether new reserves can be discovered and tapped at a sufficiently rapid pace to balance or exceed depletion of old ones. Soviet exploratory drilling efforts, moreover, are handicapped by lack of drilling equipment for depths greater than 2.8-2.9 thousand metres, and for offshore exploration.

15. To assure an uninterrupted oil flow, Soviet proven oil reserves should stand at a ratio of at least 10 tonnes of reserves to one tonne of oil currently produced. Thus, if an estimate of Soviet proven reserves of around 10 billion tonnes is accepted, the USSR should be able to maintain present production levels, given sufficient and adequate equipment, through a major part of the 1980s. A lower reserve level, however, would make a decline in oil output likely(1), and at the present rate of extraction even reserves of 10 billion tonnes would be completely depleted in less than 20 years. It appears inevitable, therefore, that oil must fairly rapidly give way as a principal source of primary energy in the Soviet Union to other types of energy - natural gas, coal, and nuclear energy.

16. At 29 trillion m3, Soviet proven and probable reserves of natural gas are the largest in the world - nearly five times those of the United States, and almost twice as large as those of Iran. Although the bulk of the reserves lie in the intemperate areas of Siberia and Central Asia, the Soviets seem to have mastered the technical problems connected with extraction in such regions, and are rapidly developing production at a rate above plan. In 1980, Western Siberia is to provide about 35% of total natural gas output, or 150 million m3.

(1) If the CIA reserve estimate of under 5 billion tonnes is valid, then the reserves to production ratio would be less than 8 to 1, short of the generally accepted minimum needed to maintain current production levels

17. Soviet proven, recoverable coal reserves are, after those of the United States, the most extensive in the world, or about one-fifth of the world total. Estimated at 110-140 billion tonnes, three-fourths of them lie in the Eastern regions, however, and are difficult to reach and develop; furthermore, much of the Siberian reserves contain substantial amounts of brown coal, which is either low in heat value, hard to transport, or not suitable for existing Soviet boilers. The USSR is attempting to overcome these difficulties by the construction of slurry pipelines, which carry finely ground coal in water, by the building of brown coal-burning electric plants near fuel sources, and by brown-coal gasification, liquefaction, and enrichment for transport. Significant results in solving the Siberian coal transport problem, however, cannot be expected in the next 5-10 years.

18. Reserves of uranium are estimated at 100-140 thousand tonnes, or over 30 times annual production(1). They amount to about one-sixth of total world reserves, and 25% more than United States uranium reserves.

(c) Investment and Development

19. Between 1975 and 1977 investment in the energy-producing industries - oil, gas, coal and electricity - absorbed around 28% of total industrial investment, a level similar to that in 1970. Beginning in 1978, however, much more emphasis has been put on investments in the oil, gas, and coal industries to promote their development in the face of rapidly rising costs, of which a high proportion stems from the difficulties of developing new resources in Siberia. In 1978, investment in these three industries alone grew by nearly one-third to a total of over 10 billion roubles; together with investments in the electricity generating sector, they amounted to around 30% of all industrial investment.

20. In 1979, although planned increases in general investments have been cut back sharply, the coal, gas, and oil industries are nonetheless receiving an additional 3 billion roubles, or a total of 13-14 billion roubles. Their share, along with electricity, has thus grown to at least 35% of industrial investment and their portion of total state investments in all sectors of the economy, including agriculture, public housing, and transportation, has grown from 6.8% in 1977 to over 10% in 1979.

(1) AC/127-WP/546, dated 4th January 1978

21. The implications of these developments are significant of the government's awareness of the energy difficulties and of its priorities: in trying to maintain a desired rate of growth in energy production, the Soviet government is denying additional investment funds to many other sectors of the economy, including other important industries and social programmes. Such a policy shows how crucial the Soviets consider the continued expansion of their energy supplies for the health of the economy as a whole.

C. SOVIET DOMESTIC DEMAND FOR ENERGY

22. It has been estimated that total Soviet energy demand in 1990 will be approximately double the 1970 level, or roughly the energy consumption of the United States in 1970(1). Such Soviet energy requirements in 1990, however, would represent only 11% of projected energy use throughout the world, as compared to 16% in 1970.

23. At present rates of consumption, presumably somewhere between these two levels, the USSR's proven and probable reserves of petroleum would last for at best 30 years, its gas reserves for about 70 years, and its coal and uranium virtually indefinitely. The Soviet Union's long-term problem of meeting its energy demands, therefore, can be seen as principally one of making a smooth and relatively rapid switch-over from current heavy dependence on oil to gas and coal, and eventually to nuclear energy.

24. Soviet domestic consumption of oil presently runs at a rate of around 400 million tonnes a year, with about 170 million tonnes left for export. By 1985 it is estimated that minimum domestic consumption needs will be 435 million tonnes a year, and around 80 million tonnes will be needed annually to fulfil probable export commitments to Eastern Europe, leading to a total minimum requirement of 515 million tonnes annually.

25. This level of demand may be some 15 million tonnes above Soviet oil production capabilities in 1985, if the country cannot discover and develop new oil output sufficiently rapidly to offset anticipated sharp declines from fields being currently worked. If the USSR succeeds in continuing to expand oil production, however, or even in holding it at current levels, it should have enough oil to meet these minimum requirements, leaving at least 20 million tonnes available for export to the West annually, for hard currency receipts of some $6 billion at 1985 prices.

(1) Devana Lavrencic (CNEN, Rome, Italy), "Nuclear Energy Supply in the USSR", Atomwirtschaft-Atomtechnik (Dusseldorf), July 1979, pp. 360-369 (as translated by US Foreign Broadcast Information Service)

26. Growth in Soviet coal production, judging from continually greater plan shortfalls over the past few years, is clearly failing to meet increases in domestic demand. Part of the coal production difficulties stem from inclement weather, since much Soviet coal is strip-mined. Failure to fulfil demand also arises from transport difficulties, because of congested conditions on the Soviet railways and freezing up of loaded freight wagons. Perhaps most importantly, the Soviets appear unable to develop new production, centred largely in Siberia, sufficiently rapidly to offset declining output in the older coal basins in the Western USSR.

27. Natural gas output has been expanding at an above-plan rate since 1976, and so has been able comfortably to meet increases in domestic demand, as well as to provide increased exports to both Eastern Europe and the West. In the next decade, however, the entire growth of output is likely to come from the giant Tyumen deposit in West Siberia, which is being developed at great cost and difficulty because of its distance from centres of gas usage and because of climatic adversities. Combined production from the country's other major gasfields in the Ukraine, North Caucasus, and Uzbekistan peaked in 1976 and has since begun to decline.

28. Nonetheless, most experts predict that Soviet natural gas production will continue to grow rapidly, at about 6% a year, reaching 435 billion m3 in 1980 and possibly 700 billion m3 by 1990. It should thus amply supply increases in domestic demand, as well as provide for steady export growth. By 1990, natural gas could be the Soviet Union's largest source of domestically produced energy.

29. Production of uranium completely satisfies domestic demand and should pose no problems for doing so at least until the Soviets switch over to breeder reactors around the end of the century. In face, the USSR now has enough uranium enrichment capacity to service part of the needs of a number of Western nations. In nuclear energy, which the USSR is counting on ultimately to fulfil the country's long-term energy demands, the largest brake on development is slowness in constructing nuclear generating facilities largely due to a shortage of nuclear reactor components and equipment and skilled manpower.

30. Electricity production in 1978 failed to meet the planned target, and presumably demand, partly because of delays in completing new power stations, especially nuclear ones which are to provide 5-6% of all electricity consumed by 1980, and 10-12% by 1985, or 1% and 2.5% of total primary energy produced in those respective years.

(a) Energy Substitution

31. Potential shortages of oil to meet both domestic and foreign demand in the mid-1980s might be remedied to some extent by the substitution of other energy sources, notably natural gas, since increases in coal output are currently not keeping up with growth in domestic demand. No more oil-burning power plants are being constructed during the current five-year plan period, and there is a certain amount of changeover in already existing plants from oil to gas. Full conversion of thermal power plants to gas, however, might take until 1990, and might lead to gas shortages; probably for this reason available plans do not provide for such a conversion. Domestic heating stations, however, are also capable of conversion to gas.

32. The principal questions in energy substitution are the amount of time needed to effect the transition and the costs involved. In economic terms, the most reasonable long-term substitution for the USSR is to nuclear power; but significant quantities of nuclear power cannot be generated before 1990.

(b) Energy Conservation

33. To conserve energy in the 1980s, the USSR has essentially three options. In the first place, it can restrain demand for additional energy by preventing the proliferation of obvious new energy users - specifically automotive transport. Some consumer discontent will undoubtedly arise if this policy is followed, but it can probably be more readily enforced than it could be in the West, where the consumer is already too dependent on the automobile to give it up easily. On the other hand, since most freight transport is already oriented to the railways, the USSR can conserve on additional demand for truck fuel by continuing their development and electrification.

34. A second means of conserving energy is to use existing energy supplies more efficiently. Undoubtedly the USSR will continue its programme of providing more urban space heating and industrial process heat through cogeneration. The USSR will also achieve marginal gains by continuing the recent emphasis on the growth of light industry, as opposed to energy-consuming heavy industry(1). In addition, efficiency of industrial technology can be upgraded, largely through imports. Most importantly, the USSR can combat widespread industrial energy wastage, by raising wholesale fuel prices and preventing their being passed on to customers. The planning and wholesale price reforms announced in mid-1979 tend to confirm the USSR's intention to use this strategy.

(1) Growth of light industry was planned at 5.4% in 1979, up strongly from an actual growth of 3% in 1976, and 4% in 1978

35. As a third approach to energy conservation, if the other two fail to achieve their desired effects, the Soviet government can deliberately plan reduced economic growth. Although Soviet investment policy shows a desire to maximize growth within the limits of existing resources, a lowering of growth targets would allow latitude for switchovers to production processes requiring less energy, and would probably make for less energy use. Moreover, the USSR can opt for reduced economic growth with more equanimity in the 1980s, in the face of a probable trend of reduced industrial growth in the West.

36. On balance, then, the USSR appears to possess a considerable number of options for further conserving energy use, which it shows every sign of adopting as needed, although Soviet energy conservation efforts to date have been characterized by President Brezhnev as a failure. The fact that Soviet industry is now biased toward heavy energy usage suggests that effecting additional conservation measures through industrial conversion will be difficult and expensive; but at the same time it suggests that only marginal conservation measures taken by individual firms will have a substantial cumulative effect.

D. TRANSPORT OF ENERGY WITHIN THE USSR

37. Planned expansion of oil and gas output in the USSR and delivery to anticipated users is dependent to a large extent on the success of the Soviet Union's pipeline construction programme(1). At the end of 1978, the USSR had 64,200 km of oil pipelines with a total throughput capacity of 589 million tonnes annually. Although they transport over 80% of Soviet crude, they carry very little in the way of refined products. Approximately one-fifth of the oil pipeline length is reserved for oil products; but because of its small diameter (529 mm maximum), it transports only one-tenth of all oil product output.

38. The USSR continues to rely heavily on its railroads and roads for the transport of refined products. In 1977, 37% of all oil and product output, by weight, was shipped by rail, down from 40% in 1970 and 46% in 1950. The continued extensive reliance on the railways for oil transport, caused in part by lagging pipeline construction, blocks their use for other important commodities and causes certain economic dislocations, including shortcomings in efficient energy use(2).

(1) For more detailed information on Soviet oil and gas pipelines, see AC/127-D/604 and AC/127-D/605. For maps showing existing pipelines and currently producing fields, see Annex VI

(2) On a cost basis, for instance, more Kuzbass coal from Siberia should be transported to the European USSR for coking; but it is not, because of East-West transport bottlenecks

39. The USSR plans to extend its oil pipeline network to 75,000 km by 1980, and half the new lines will provide additional throughput capacity of 42-78 million tonnes. The bulk of the new pipeline construction is in Siberia, however, where railway infrastructure is lacking, and where construction is delayed by climatic extremes, flooding, and swamps. As a result, pipeline construction costs in Siberia are about twice as high as, for example, in the Volga/Ural area.

40. Judging by past performance, the actual amount of oil pipeline in place by 1980 might be only around 70,000 km, providing a total annual throughput of over 640 million tonnes. Even this additional length, however, does not guarantee the indicated amount of pipeline transport capacity: Soviet oil pipeline operation in the permanent frost areas is often interrupted by pipeline dislocations and bursts during the thaw periods.

41. The Soviet gas pipeline network, on the other hand extended 110,000 km at the end of 1977, the second largest in the world after that of the United States. Between 1965 and 1975, gas pipeline length in the USSR more than doubled. By 1980, the network is to reach 135,000 km, although construction is currently at least 3,000 km behind schedule, primarily because of the extremes of climate in Siberia, where construction is concentrated. It seems certain that 1980 construction targets will not be reached, thus preventing transport of all of the 150 billion m3 of gas from Siberia planned for that year. By 1985, the gas pipeline network may extend 160-170 thousand km.

42. Nearly one-third of all gas pipes laid in the 1976-1980 period, and practically all of those laid in Siberia, have a diameter of 1,420 mm to reduce gas transport costs over long distances. The USSR, which is the first country to use pipes of this diameter on a large scale, must import most of them from the West, since it does not have enough factories to produce pipes of this size in required quantities. Of a total of 13 million tonnes of large diameter pipes needed during the 1976-1980 period - 10 million tonnes for the gas industry and 3 million tonnes for the oil industry - 4-5 million tonnes, or 30-40% must be imported. Nonetheless, in order to increase the transport capacity of the pipelines further, the Soviet gas industry intends to lay pipelines with diameters of 1,520 mm and 1,620 mm in the future.

43. Some Soviet gas pipelines operate at as little as one-third of planned throughput because of a lack of pumping stations and cracks and fissures. Along the Orenburg Pipeline, for instance, which was completed on schedule in 1978, 22 compressor stations are required for the planned operating pressure of 75 atmospheres. Only one compressor station was actually in place at the pipeline's completion, however; the remaining 21 will not be installed and operational before 1980 or 1981. In global terms, from 1966 to 1975 about 240 compressor stations were installed in the USSR. Another 300 were to be installed in the period 1976-1980, although in 1977 alone 36 stations could not be put into operation on schedule, partly because of insufficiencies in Soviet production capacity. By 1985, however, an additional 250-300 compressor stations are to be installed.

44. Soviet gas pipelines develop fissures partly because of poor welding and material flaws. Moreover, they are exposed to heavy corrosion because the gas is often insufficiently purified of sulphuric contents before being pumped(1).

45. In sum, future Soviet oil and gas availability will be determined not simply by the rate of development of new fields and consequent production growth, but also, especially for gas output, by the USSR's success in procuring, installing, and maintaining the required amount of large-diameter pipe and compressor stations.

E. SOVIET FOREIGN ENERGY TRADE

(a) With the West

46. The USSR's principal energy export to the West is petroleum, which earns the country over $6 billion annually, or about one-half of convertible currency receipts from commodity trade. With moderate economic growth (under 3% annual increase in GNP) and some success in energy substitution and conservation, the USSR might have approximately 20 million tonnes of oil available for export to the West annually by 1985, for hard currency earnings at approximately the same level in 1985 dollars as at present(2). If oil production drops severely, on the other hand, to around 500 million tonnes a year, the USSR might well

(1) On 18th September 1979, however, the USSR announced that it has developed a new type of multi-layer pipe which is practically non-destructive, resists extreme cold, and can withstand pressures of 120 atmospheres - 60% more than the current standard operating pressure of Soviet gas pipelines

(2) This is on the assumption of an inflation rate and price increase for oil totalling some 20% per annum

become a net oil importer, after delivery obligations to Eastern Europe were met; in this case, it might import around 15 million tonnes of oil a year at a cost of around $4.5 billion in 1985 prices(1), a sum it could probably afford, through increased sales of gold, other raw materials, and arms. Financing could also be arranged through short or medium-term borrowing.

47. Partially to offset probably declining oil exports in the 1980s, the USSR may increase sales of natural gas to the West. Deliveries of natural gas to Western Europe may amount to some 28 billion m3 by 1985, for earnings of perhaps $3-4 billion. Natural gas exports would not yield significant earnings of hard currency until after 1985, however, because 90% of the annual amount earned until that time will represent equipment amortization expenses.

48. Even if Soviet oil exports to the West amounted to several billion dollars annually in 1985, they would not exert exceptional economic influence, since they would represent at best only some 5% of the total imports of the industrial West. Strategically, they would be even less significant, since their quantity would probably fall from the present level of over 60 million tonnes annually. Soviet exports of natural gas, on the other hand, might become strategically important by 1985, since West European production of natural gas will be falling off about that time. Altogether, Soviet natural gas supplies might account for one-fourth of West European consumption by 1985.

(b) With Eastern Europe

49. Soviet deliveries of oil to Eastern Europe in the 1981-1985 period will probably continue at about the 1980 level, or around 80 million tonnes annually. The USSR will probably maintain this level partly for political reasons, and partly to sustain near full-capacity operation of the Druzhba pipeline.

50. Deliveries of natural gas, on the other hand, will probably increase to 40-43 billion m3 annually by 1985, up from their present level of around 33 billion m3 a year. They will thus partially help to offset the lack of increase in oil exports to Eastern Europe.

(1) This is on the assumption of an inflation rate and price increase for oil totalling some 20% per annum

51. Soviet exports of electricity to Eastern Europe, which now amount to approximately 1% of total Soviet production and 3% of East European output, will probably double by 1985. Exports of coal will expand only marginally.

52. The East European countries will thus be forced to turn to other suppliers to meet their additional energy needs, particularly for oil. Over the longer term, the Soviet Union will continue to work closely with the East European countries on the development of nuclear energy, so dislocations caused by possible oil shortages in Eastern Europe may prove to be only temporary. Under existing agreements, the USSR is to build nuclear reactors in co-operation with the East European CMEA nations which will increase their nuclear power plant capacity considerably by 1990.

53. The probability that the East European nations will have to pay higher prices for their oil imports, however, both from the Soviet Union and elsewhere, suggests that the East European countries' balances of payments may become even more strained, and lead the countries to seek financial and trade assistance from the USSR and the West. As a result, either the USSR or the West might have opportunities for heavier economic and political leverage in Eastern Europe.

F. CURRENT AND FUTURE ENERGY REQUIREMENTS IN EASTERN EUROPE

54. The magnitude of energy output and consumption of the various CMEA countries of Eastern Europe, as contrasted to those of the USSR, are represented graphically in the diagram overleaf. Specific statistics on present and projected energy production and consumption in Eastern Europe can be found at Annex II, and a brief country-by-country survey of the energy situation in Eastern Europe is given in Annex III.

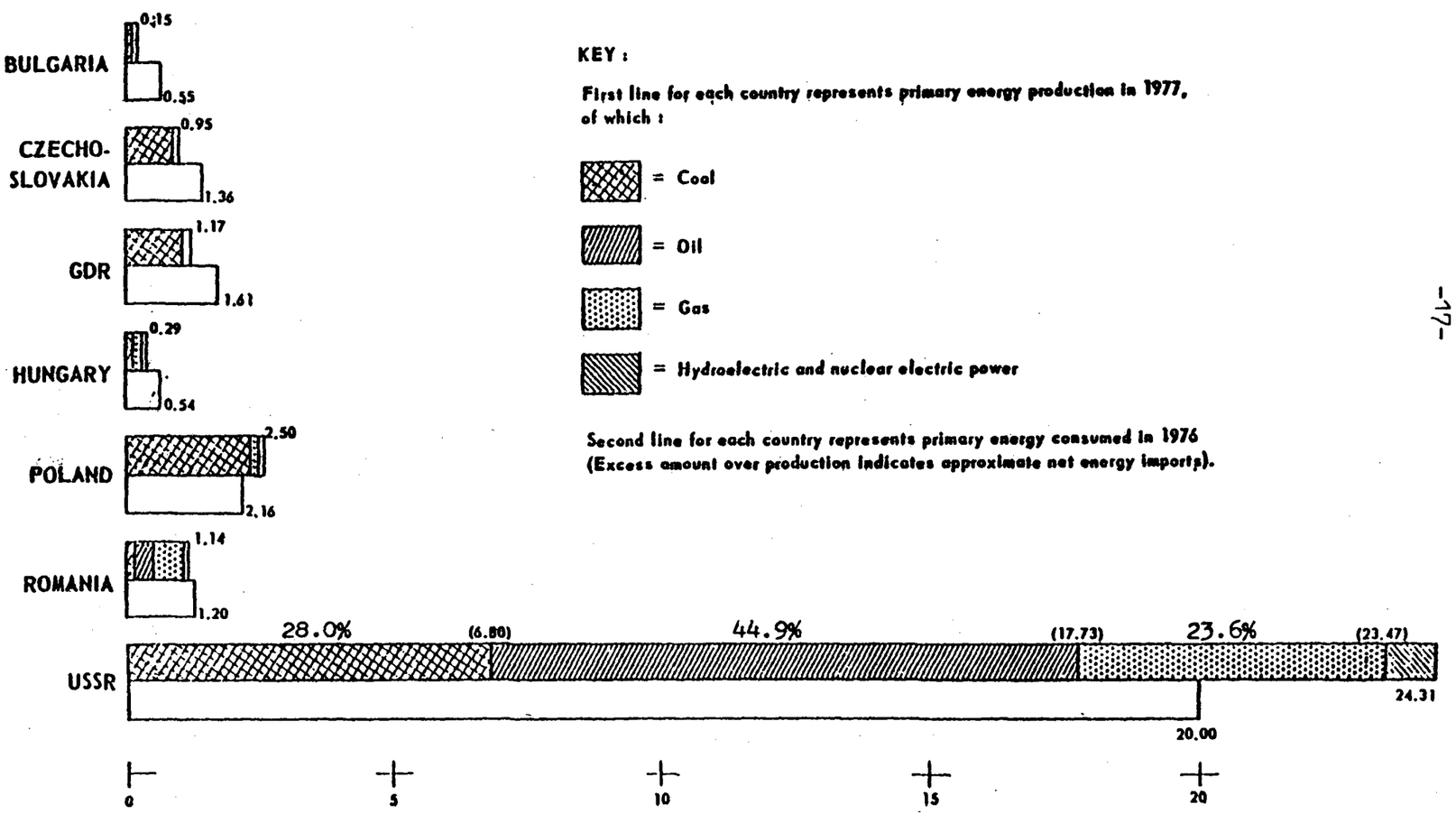
55. In brief, the situation is that, although the area as a whole has an exportable energy surplus, due primarily to the USSR's preponderant supplies of oil and natural gas(1), all the East European countries except Poland cannot cover their total energy requirements from their own national resources, principally coal. They are thus dependent on foreign fuel supplies to make up their respective energy deficits. The USSR is their principal foreign fuel supplier, providing over 90% of their oil and gas requirements in many cases(2).

(1) See Annex V, "The Energy Balance in COMECON"
(2) See Annex VI, "East European Energy Dependence"

THE ENERGY BALANCE IN THE USSR AND EASTERN EUROPE 1976 - 1977

C-M(80)5

(MILLION BARRELS PER DAY OIL EQUIVALENT)



KEY :

First line for each country represents primary energy production in 1977, of which :

= Coal

= Oil

= Gas

= Hydroelectric and nuclear electric power

Second line for each country represents primary energy consumed in 1976 (Excess amount over production indicates approximate net energy imports).

-17-

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56. The outlook for the 1980s is that the USSR will continue to be Eastern Europe's principal supplier of oil and natural gas, although bilateral agreements presently being concluded indicate it will not expand oil deliveries beyond levels anticipated for 1980 of about 80 million tonnes a year. To help compensate for its failure to increase oil deliveries, it will probably expand deliveries of natural gas to around 43 billion m3 a year by 1985, and in the same period will probably double deliveries of electricity over current levels. Altogether, the USSR has pledged to deliver 20% more energy to Eastern Europe during the 1981-1985 period than during the previous five years.

57. To make up for possible shortages in oil supplies, the East European countries may increasingly search for alternative deliveries from such countries as Libya, Algeria, and Iraq, especially through compensation agreements. Poland, for instance, has a long-term agreement with Libya for oil in exchange for road equipment, and the GDR has a long-term contract with Iraq for oil in exchange for drilling equipment. In addition, when the Adria pipeline begins its scheduled operation in 1981, it is to deliver 5 million tonnes of oil annually to Czechoslovakia and Hungary, respectively, from Libya and Iraq via Yugoslavia.

58. The possibilities of conserving energy in Eastern Europe appear to be slight, as the countries have a large amount of out-dated, inefficient industrial machinery and work practices which lead to a great deal of energy wastage. The GDR is taking perhaps the most stringent measures to conserve energy, with the passage of a law in April 1979 which provides for heavy punishment of firms using more energy than planned. Additional energy conservation throughout the East European area might be gained in a few years through further centralization of urban heating systems. The most effective conservation measures, however, can be attained only by wholesale price increases for energy products, such as will be applied in the GDR beginning in 1980.

59. In the longer term, nuclear power will provide for increasingly greater amounts of East European energy requirements. Czechoslovakia and the GDR in particular have extensive uranium reserves, and the countries of Eastern Europe together produce twice as much uranium as the USSR, or 9,500 tonnes annually, as compared to the USSR's 4,500 tonnes. Under nuclear power plant construction programmes currently underway Eastern Europe is to install an additional 37 billion kilowatts of nuclear generating capacity, or over twelve times its present nuclear generating capacity and more than two-fifths of its total installed electricity generating capacity in 1978. Nuclear energy is to

provide 20% of the electricity generated in Eastern Europe by 1990, or 5% of the area's total energy consumption. In addition, under long-term agreements signed with the USSR, Eastern Europe is to receive half of the electricity produced at two 4 billion kilowatt nuclear plants located in the Ukraine, in return for helping to build these plants. Current delays in Soviet nuclear power plant construction, however, suggest that the capacity will fall short of the target level.

G. CONCLUSIONS

60. Because of the large rôle played by Soviet oil in CMEA energy supplies, and the difficulties of changing over quickly to other energy sources, an analysis of the energy situation in the CMEA during the 1980s must depend to a large extent on the expected level of Soviet oil output. On this figure, however, Western experts diverge considerably. At worst, Soviet oil production by 1985 may have dropped nearly 100 million tonnes from its present level, in which case domestic consumption and deliveries to Eastern Europe would be forced to remain at approximately present levels, and perhaps some 15 million tonnes of Western oil would be imported. This situation implies perhaps strongly curtailed economic growth in the USSR and Eastern Europe, as well as possible CMEA competition to purchase oil from current Western suppliers, with the result of probably diminishing oil supplies to the lesser developed countries, and pushing the cost of oil up even higher to the industrial West. In addition, Soviet purchases of Western oil would reduce its possibilities for foreign purchases of needed technologies and grains; and internally reduced economic growth within the USSR and other CMEA nations could generate consumer discontent and pressures for reduced military spending.

61. An assumption of Soviet oil production remaining at approximately present levels would allow for modest increases in domestic consumption to as much as 70 million tonnes over current levels by 1985, continued deliveries to Eastern Europe at approximately present levels, and some exports to the West, which might continue to bring in as much as $6 billion annually in convertible currency earnings because of inflation and large increases in world oil prices. Under this assumption, real GNP growth in the Soviet Union might be slightly reduced to a level below 3% yearly, but military spending would not necessarily be affected. Under an assumption of continued increases in Soviet oil production, GNP growth in the USSR could continue at its present rate of above 3%, and convertible currency earnings from oil sales would probably increase.

62. Under all these assumptions, the energy situation could gradually improve after 1985, as on-going conversion to other energy sources, and possible modest successes in energy conservation, begin to have a perceptible effect on the CMEA economies. In fact, conversion in the 1980s to coal and natural gas, the latter of whose production is currently expanding above plan, might be sufficiently rapid to offset many of the possible ill effects of a potential decline in oil production.

63. On balance, the 1980s will probably be a period of tight and certainly increasingly costly, energy supplies for the USSR and Eastern Europe.

(Signed) J.N. GIBAULT
Chairman

ANNEX I to
C-M(80)5

TABLE 1

SOVIET ENERGY PRODUCTION AND TRADE, 1975-1978

Year	Energy Source (Unit of Measure)	Production Actual	Production Plan	% of Total Primary Energy Production (a)	Imports (Total)	Exports Total	Exports To E.E.	Exports (Val.$ bill.)	Exports To West	Exports (Val.$ bill.)
1978	Oil (mil.t.)(b)	572	575	45(d)			80.5		63(g)	(6.7)(d)
	Gas (bil.m3)	372	370	24(d)		35(d)	20(d)		15(d)	(1.0)(g)
	Coal(mil.t.)(c)	723	746	27(d)						-
	Electricity(bil.kWh)	1,202	1,207	1(d,e)		12.2				
	- Nuclear(bil.kWh)	44.7								
1977	Oil (b)	546	550	44		160.0			55(g)	(5.6)(g)
	Gas	346	342	23		-				(0.6)(g)
	Coal	722	733	27		-				(0.4)(g)
	Electricity	1,150	1,160	1(e)		11.5				-
	- Nuclear	34								
1976	Oil (b)	520	520	43		148.5	68.4	(3.4)	47.2(g)	(4.5)(g)
	Gas	321	313	22	11.7	25.8	13.6	(0.6)	12.3	(0.3)(g)
	Coal	712	715	28	10	26.8	17.2(i)	-	9.6(h)	(0.4)(g)
	Electricity	1,111	1,095	1(c)		11.6			-	-
	- Nuclear	25								
1975	Oil (b)	490		43		130.4	63.3	(3.3)	38.2(g)	(3.2)(g)
	Gas	289		21		19.3				(0.2)(g)
	Coal	701		29		30.4				(0.4)(g)
	Electricity	1,039	1,065	1(e)		11.6	9.8			
	- Nuclear	20.2		0.1(b)						

(a) In terms of standard fuel (7,000 kilo calories)
(c) Including brown coal
(d) Estimated
(e) Hydroelectric power only
(f) Calculated
(g) Hard currency area
(h) Non-Communist world
(i) Communist countries

Sources: CMEA statistics; NATO member estimates; OECD

TABLE 2

USSR EXPORTS OF ENERGY PRODUCTS

	1975	1976	% (1976)
Coal (thousand tons)			
Total	26,143	26,896	100
Western Europe:	6,974	7,815	29.1
Austria	735	745	
Belgium	225	346	
Denmark	387	653	
Italy	1,230	1,260	
FRG	141	222	
Finland	486	528	
France	1,719	1,554	
Sweden	584	603	
Greece	26	31	
Yugoslavia	1,441	1,873	
Japan	3,303	3,224	12.0
CMEA countries:	14,948	14,970	55.7
Bulgaria	6,006	6,083	
Hungary	382	368	
GDR	3,964	3,837	
Poland	1,141	1,126	
Romania	635	664	
Czechoslovakia	2,820	2,892	
Coke (thousand rubles)			
Total	207,485	207,015	100
Austria	4,902	4,393	
Finland	41,687	43,076	
Sweden	215	81	
Total	46,804	47,550	23.0
Bulgaria	11,943	12,171	
Hungary	33,338	34,765	
GDR	51,550	52,009	
Romania	44,368	45,283	
Total	141,199	144,228	69.7

TABLE 2 (cont.)

	1976	1977	% (1977)
Petroleum & Products (million rubles)			
Total	7,676	9,400	100
Western Europe:			
Austria	99	148	50
Belgium	139	146	
Cyprus	13	13	
Denmark	109	160	
FRG	577	683	
Finland	638	716	
France	372	391	
Greece	130	208	
Iceland	32	38	
Ireland	8	21	
Italy	783	744	
Netherlands	221	268	
Norway	15	55	
Spain	128	121	
Sweden	167	192	
Switzerland	67	77	
United Kingdom	279	339	
Yugoslavia	318	343	
Japan	113	63	1
CMEA countries:			
Bulgaria	445	587	36
Czechoslovakia	587	741	
GDR	538	699	
Hungary	377	503	
Mongolia	26	35	
Poland	592	802	
Vietnam	14	28	
Other indicated destinations:			8
Afghanistan	14	19	
Cuba	288	375	
Egypt	20	18	
Ghana	16	11	
Guinea	7	8	
India	98	191	
Morocco	43	47	
North Korea	44	47	
Somalia	9	10	

Source: USSR Foreign Trade Yearbook, 1977, p. 61

TABLE 2 (cont.)

	1976	1977	% (1977)
Natural gas (million rubles)			
Total	751	1,023	100
Western Europe:			38
Austria	94	106	
FRG	91	146	
Finland	42	43	
Italy	52	97	
CMEA countries:			51
Bulgaria	74	106	
Czechoslovakia	148	178	
GDR	95	137	
Poland	84	100	

Source: USSR Foreign Trade Yearbook, 1977, p. 61

TABLE 3

ACTUAL AND PROJECTED USSR EXPORTS OF NATURAL GAS TO WESTERN EUROPE

(bn. m3)

	1975	1976	1978	1980 (est.)
AUSTRIA	2.0	2.8	2.4	2.4
FINLAND	0.7	0.8	1.0	1.4
FRANCE	-	-	2.5	4.0
FRG	3.0	4.0	6.5	9.5
ITALY	2.3	3.7	6.0	7.0
TOTAL	8.0	11.3	18.4	23.3

ANNEX II to
C-M(80)5

ENERGY PRODUCTION IN EASTERN EUROPE ACTUAL AND PROJECTED

TABLE 1 - POLAND

	1976	1977	1978	1980	2000
Oil (m.tonnes)	0.5	0.6	5-6	5-6	
Gas (bn. m3)	6.6	5.7	5-6		
Coal (hard) (m.tonnes)	179	186		207	
Electricity (bn. kWh)	104	109.4			
Energy consumption (annual % increase)					3.9*

* 1975 = 100

TABLE 2 - GDR

	1976	1977	1978	1980	1990
Electricity (bn.kWh)	89.1	92	96-97	104-109	
Coal (m. tonnes) (Lignite)	247	253	254	250-54	250-54
Oil (m. tonnes)	1-2	1-2	.3	.3	
Natural gas (bn.m3)	1973-77 average: 8	7-8	7-8	8	
Nuclear Power(bn.kWh)	5.27	5.21			40%*

* 40% of all installed electricity capacity by the year 2000

TABLE 3 - CZECHOSLOVAKIA

	1976	1977	1978	1980	1990
Oil (m.tonnes)	m i n i m a l				
Coal (m.tonnes)	115	118-119	123.1	123.1	
Gas (bn. m3)	.93	.9			
Electricity (bn. kWh)	62.6	65	69.1		
Nuclear Power(bn. kWh)	.44	.11			10,500 MW capacity

TABLE 4 - ROMANIA

	1976	1977	1978	1980	1990
Electricity (bn.kWh)	58.2	63.1	64.5 (Plan)	75-79	130-140
Coal (m. tonnes)	27.1	33.5	36-37	53-56	
Oil (m. tonnes)	14.8	13.8	13.7	15.5	
Natural gas (bn. m3)	31.4	28		946 bn cu. ft	
Nuclear Power(bn. kWh)	0	0	0	0	= 20% of total installed capacity
Power consumption (yearly % increase)					As double between 1976-1990

TABLE 5 - HUNGARY

	1976	1977	1978	1980	1990
Oil (m. tonnes)	2.13	2.1	2.2	2.2	28-30
Coal (m. tonnes)	25.2	25.4	25	24-25	
Gas (bn. m3)	6.2	6-7	7-8	10	
Electricity (bn.kWh)	20.4	24	25-26	27.5	
Nuclear Power	0	0	0	0	10% of total

TABLE 6 - BULGARIA

	1977	1978	1980	1990
Electricity (bn.kWh)	33	35.6	41.8	
Coal (m. tonnes)	26	29	38	56.5
Oil (m. tonnes)	0.12	minimal		
Natural gas (bn. m3)	-			
Nuclear Power(bn.kWh) % increase	5.88	6.0	(20% of electric power production	(35% of electric power production) Double 1980
Power consumption (% increase)	7%	7%	7%	

ANNEX III to
C-M(80)5

THE ENERGY SITUATION IN EASTERN EUROPE
COUNTRY-BY-COUNTRY SURVEY

POLAND

1. The energy balance is delicately poised between two major sectors: electricity which despite good growth figures for the past three years has not been able to meet soaring demand, and a massive hard coal industry that meets both domestic and export demand of about 40 million tonnes a year. Until the year 2000, coal will continue to be the primary energy source for Poland, with lignite in second place. Oil production is very low, and 80-90% of supplies come from the USSR, with the balance from Iraq and Middle East countries. On the other hand, Poland has greatly expanded its refinery capacity in connection with both energy needs and the development of the country's large petrochemical industry. Natural gas production is modest and again the Soviets have met, via the Orenburg (Soyuz) pipeline, most of Poland's needs. Nuclear power is only in its infancy in Poland, as the government is just beginning to build one reactor which is to be ready in 1983.

GDR

2. The German Democratic Republic's energy position is deteriorating. Lignite production is becoming increasingly difficult, and oil and gas reserves are insignificant. Yet the economy possesses the highest proportion of energy-intensive products and technologies in CMEA. As a result, the country has to import almost all its oil needs from the USSR at an increasing cost and burden on its already large net debt. The recent harsh winter has not helped the situation. The authorities are placing more emphasis on energy conservation than in the other CMEA countries and are striving to maintain both minimum increases in energy consumption as well as an expansion of CMEA energy integration projects and contracts. As is the case in the rest of CMEA, electrical power is destined to be the energy foundation for the overall economy, although supply can barely keep up with demand.

CZECHOSLOVAKIA

3. The energy situation has deteriorated in the past few years, and the recent high-level Soviet-Czechoslovak talks reflect the seriousness of the latter's position. Electricity output has failed to meet domestic demand, and this has led to several power cuts throughout the country. Oil supplies are almost all imported and account for over one-third of the country's total import bill.

Nuclear power plans are impressive and ambitious, but the country has only one power station at Juslovske Bohunice (VVER 440). Recent delays on the construction of other reactors seem to indicate a lack of technical expertise.

ROMANIA

4. Although Romania is not yet in a crisis state, it is approaching this situation due to shortfalls in electricity production; its decreasing oil and coal reserves have forced the government to purchase OPEC oil at world prices. Nevertheless, Romania's energy position is somewhat better than that of the rest of Eastern Europe because of two major advantages:

(a) it is able to earn considerable hard currency or trade barter advantages through its expertise as an oil technology exporter;

(b) Romanian natural gas production is large and is playing a major rôle in meeting domestic energy demands, thereby allowing oil to be processed in high value refining or chemical processes.

HUNGARY

5. The energy situation is fairly tense as energy imports are assuming a larger share of the country's needs; domestic output of oil and gas is unlikely to increase. Electricity production barely meets demands, although some measure of help has been provided by the recently completed high voltage link with the USSR. Nuclear power production (at PAKS) is in its infancy and may remain so given the present hostility of Hungary's close neighbour, Austria, to any growth in nuclear power.

BULGARIA

6. Bulgaria has a tight energy situation. Great stress is placed on the predominent rôle of electricity in the energy picture as there is little domestic oil or gas production. The Soviet Union supplies almost all of Bulgarian oil (10 million tonnes annually) and gas (3 billion m3, rising to 5-8 billion m3 in 1980). The government's effort towards energy conservation has increased in the last two years. Bulgaria satisfies only about 33% of its power need with domestic resources, yet energy consumption in many key sectors such as glass and cement is 25-40% higher than in Poland and the GDR. A measure of demand outstripping supply was evident in the frequent failures in electricity power supply throughout the country last year.

ANNEX IV to
C-M(80)5

THE ENERGY BALANCE IN COMECON

TABLE 1

COMECON(1) FUEL BALANCE (million tonnes SFE)

	1970 actual	1975	1976	1980 estimated	% annual increase 1976-1980
Production:					
- Soviet Union	1168.2	1525	1612	1992	5.5
- East Europe	324.1	360.2	369.7	397	1.9
Total	1492.3	1885.2	1981.7	2389	4.8
Consumption:					
- Soviet Union	1065.4	1312.7	1347.2	1693.6	5.2
- East Europe	382.2	473.6	495.3	584.1	4.2
Total	1447.6	1786.3	1842.5	2277.7	5.0
Balance	+43.7	+98.9	+139.2	+111.3	

Country energy tables converted into SFE on the following basis:
1 tonne coal = 0.8 tonnes SFE; 1 tonne lignite = 0.3 tonnes SFE;
1 tonne oil = 1.43 tonnes SFE; 1,000 cu. m. gas = 1.19 tonnes SFE

TABLE 2

COMECON(1) OIL BALANCE (million tonnes)

	1970	1975	1976	1977 (2)	1978 (est.)	1980 (est.)
Production:						
- Soviet Union	353	491	520	546	575	640
- Romania	13.4	14.6	14.7	14.7	15.1	15.5
- Hungary	1.9	2	2.1	2.2	2.1	2
Total	368.3	507.6	536.8	563.9	592.2	657.5
Consumption:						
- Soviet Union	262	368.2	378.7	395	410	443
- East Europe	50.2	81	87.6	94	98.8	116.2
Total	312.2	449.2	466.3	489	508.8	559.2
Exportable surplus	56.1	58.4	70.5	74.9	83.4	98.3

(1) Excluding Cuba and Mongolia (2) Preliminary

TABLE 3

COMECON(1) NATURAL GAS BALANCE (bn cu.m)

	1970	1975	1976	1977	1978 (est.)	1980 (est.)
Production:						
- Soviet Union	198	289	321	346	370	435
- East Europe	40.7	47.2	51.4	51.3	50.4	49.8
Total	238.7	336.2	372.4	397.3	420.4	484.8
Consumption:						
- Soviet Union	198	282	307	323	346	394
- East Europe	43	58.6	65.2	66.8	69.5	78.9
Total	241	340.6	372.2	389.8	415.5	472.9
Balance	-2.3	-4.4	+0.2	+7.5	+4.9	+11.9

(1) Excluding Cuba and Mongolia

ANNEX V to
C-M(80)5

EAST EUROPEAN ENERGY DEPENDENCE

	1970 % of needs imported from		1975 % of needs imported from		1976 % of needs imported from		1980(1) % of needs imported from	
	USSR	Other	USSR	Other	USSR	Other	USSR	Other
Bulgaria	52	3	67	4.2	70	3.5	73	3.4
Czechoslovakia	23.5	1	34	1.5	35	1.4	36	7.6
GDR	15.7	5.2	24.7	3.7	25.5	3.7	27.5	7.2
Hungary	26.5	7	33.5	10.3	36	10.5	47.7	5.7
Poland	8.4	1.2	12.5	2.3	12.4	3.3	12.8	7.5
Romania	1.5	3.4	1.5	4.5	1.4	4	3.9	4.8
Total East Europe	16	3	22.3	3.5	23	3.7	25.6	6.6

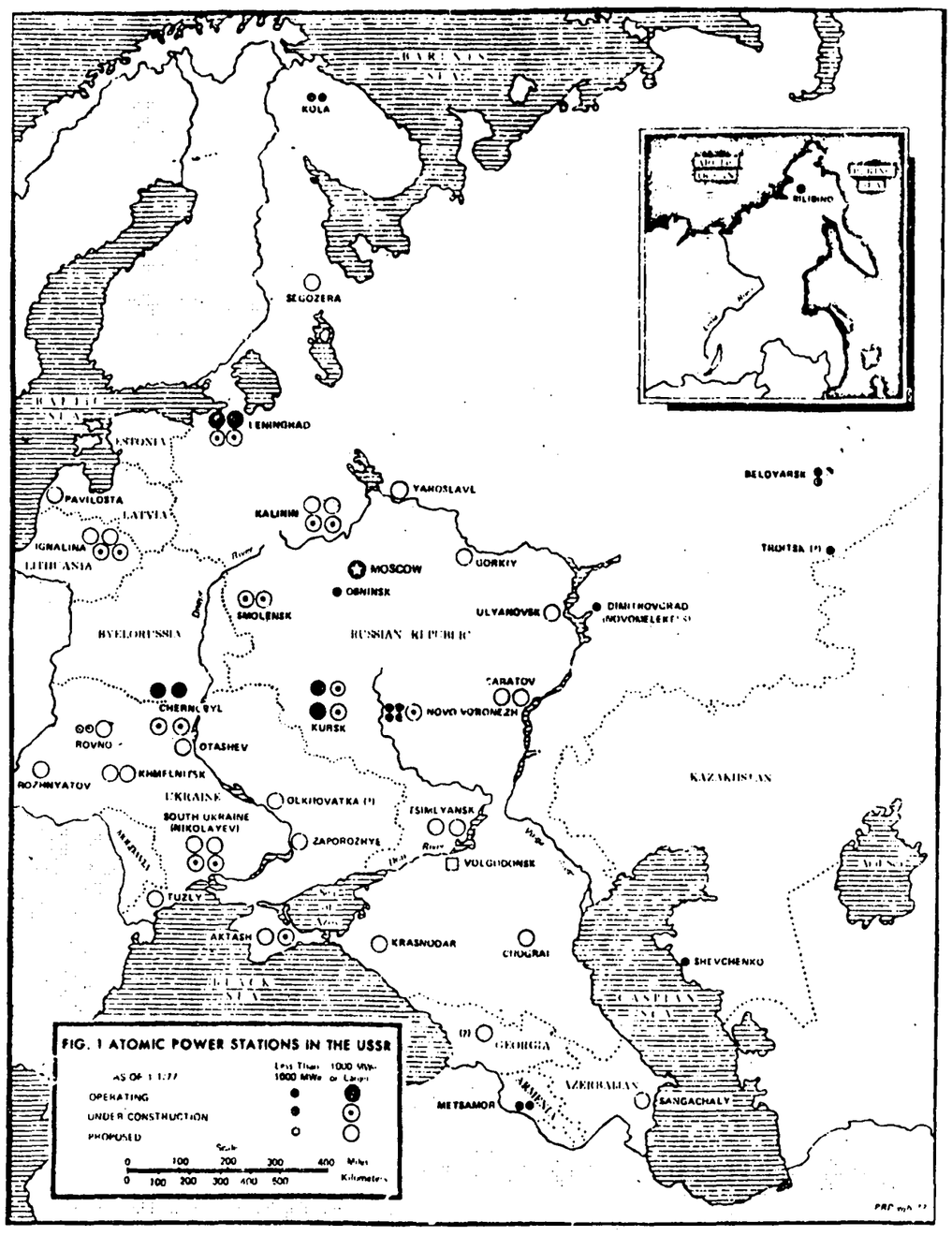
(1) Estimated on basis of Five-Year Plans.
The figures do not include electricity.

Country energy tables converted into Standard Fuel Equivalents (SFE)

MAP 1

USSR

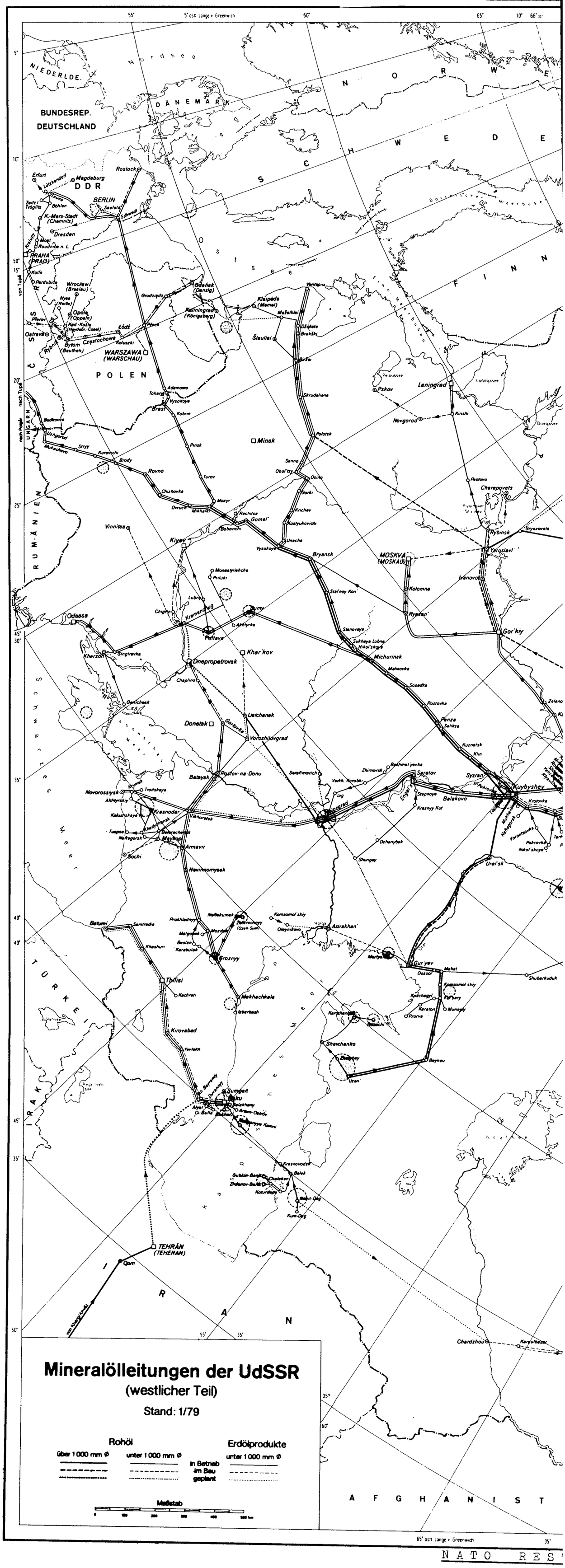
NUCLEAR POWER PLANT LOCATIONS



SOURCE : P. Pryde, "Nuclear Energy development in the Soviet Union "
Paper given at the AAASS meeting in Washington, October 1977.

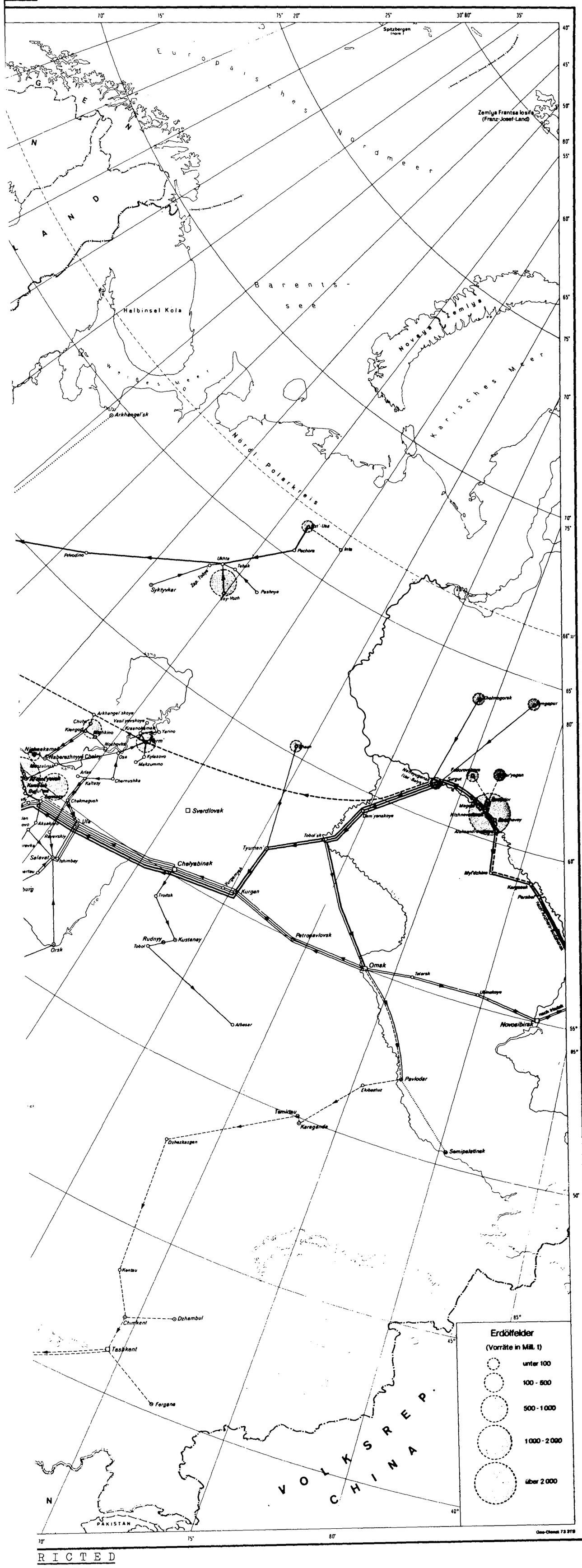
MAP 2(A)

PRINCIPAL OILFIELDS AND OI
WESTERN RE



L PIPELINES IN THE USSR
GIONS

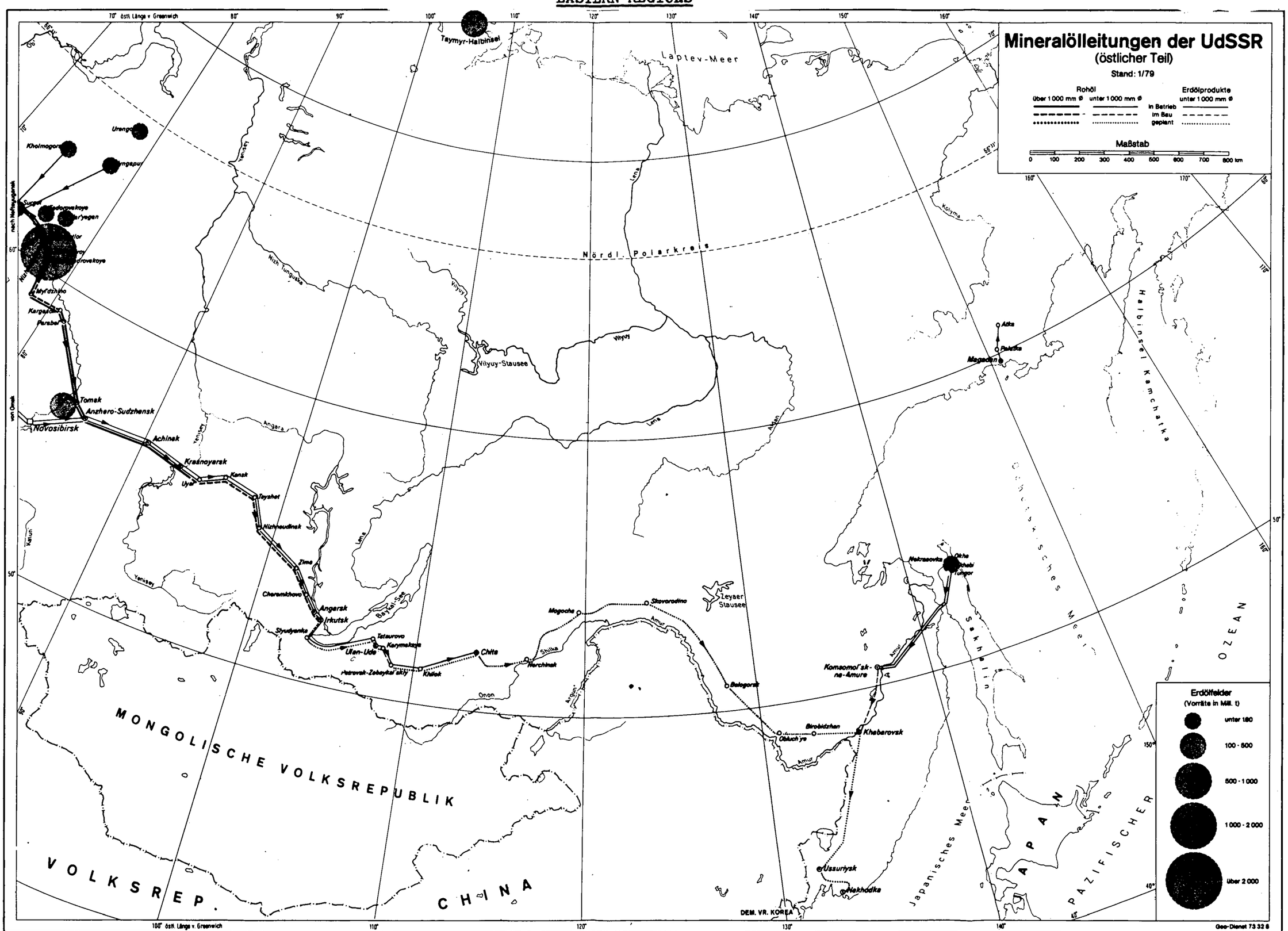
ANNEX VI to
C-M(80)5



MAP 2(B)

PRINCIPAL OILFIELDS AND OIL PIPELINES IN THE USSR EASTERN REGIONS

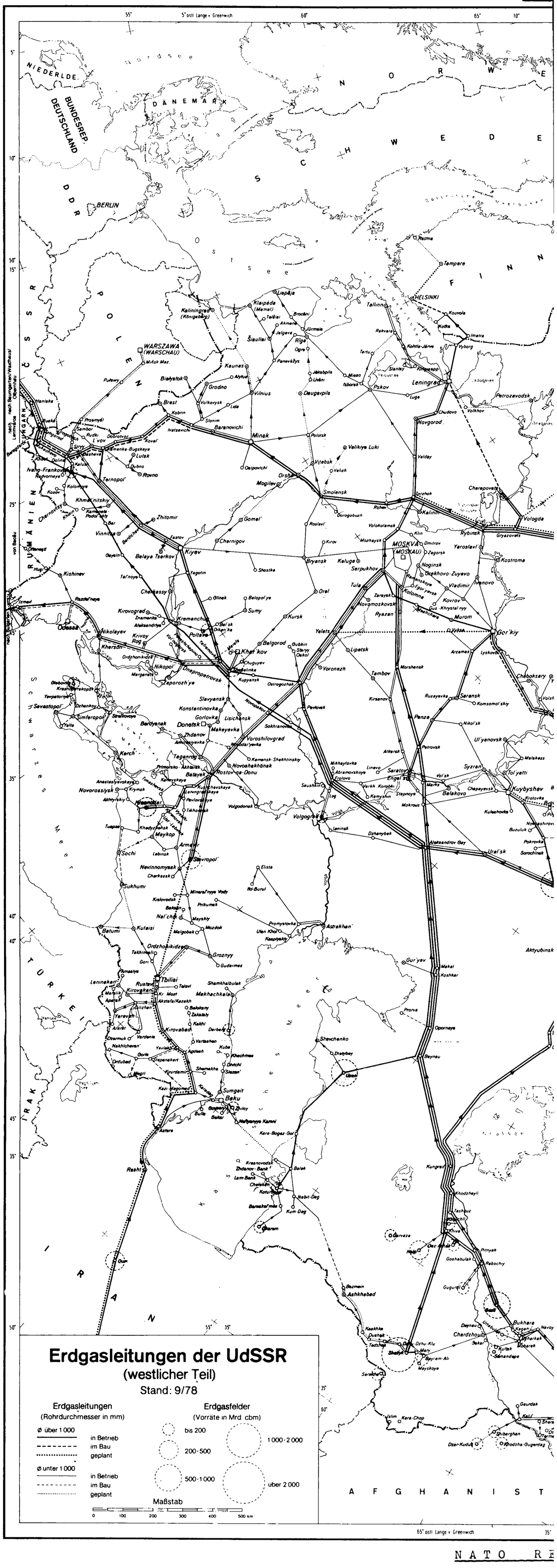
ANNEX VI to C-M(80)5



NATO

MAP 3(A)

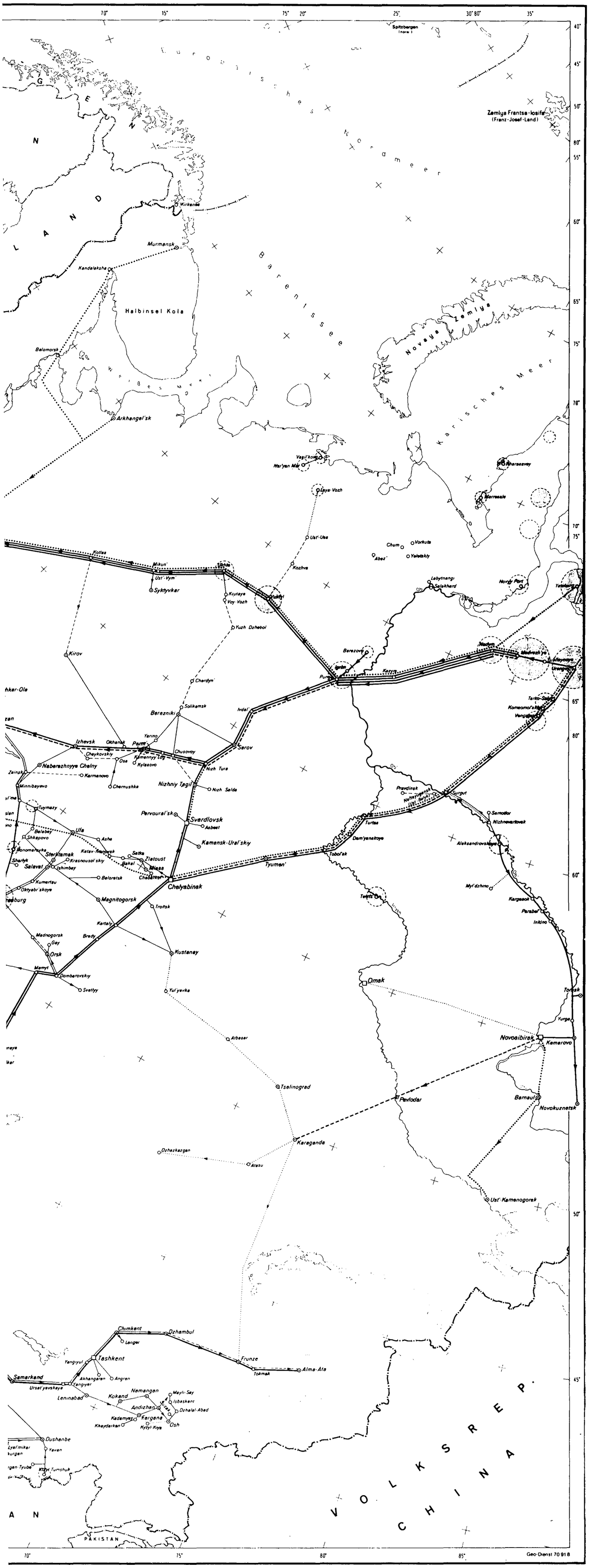
PRINCIPAL GASFIELDS
WEST



NATO RE

AND GAS PIPELINES IN THE USSR
ERN REGIONS

ANNEX VI to
C-M(80)5



MAP 3(B)

PRINCIPAL GASFIELDS AND GAS PIPELINES IN THE USSR
EASTERN REGIONS

ANNEX VI to
C-M(80)5