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ECONOMIC COMMITTEE

ENERGY IN COMECON: PROBLEMS AND
PROSPECTS, 1977-1990

Note by the Chairman

Members will find attached a summary, followed by a draft of the paper dealing with COMECON energy prospects to 1990.

2. Considerable effort has been made to take into account the views expressed at the reinforced meeting of 24th-25th October, 1977 as well as contributions from various capitals and, in particular, papers from the German, United States, United Kingdom and French Delegations.

(Signed) J. BILLY

NATO,
1110 Brussels.

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ENERGY IN COMECON: PROBLEMS AND PROSPECTS, 1977-1990

SUMMARY

PART I - SOVIET UNION

A. SOVIET ENERGY: AN OVERVIEW

In 1977 Soviet production of crude oil and coal was the largest in the world, and extraction of natural gas, second only to that of the USA. Soviet reserves of all three major fuels are considerable, but the importance of the traditional producing areas is declining and output growth rates are falling. To compensate for the depletion of older reserves and to provide for future growth, Soviet fuel industries are having to move to regions which are remote from the consuming areas and subject to harsh climatic conditions.

2. Efforts are also being made to direct gas and oil to more efficient use by replacing them with coal or gas, respectively, as boiler and thermal plant fuel. Thus, oil consumption is expected to increase by only 4.5-5% a year up to 1980 and to level out at about 38-39% of the total energy balance. Natural gas is continuing to increase its share of the total energy consumption and may replace oil as the largest single source of energy by the mid-1980s.

B. SECTORAL ANALYSIS

Oil

3. The Soviet Union's supply of oil is forecast to rise at 5% a year from 1976 to 1980, enough to meet both domestic and export demands. After 1980, however, there is less certainty that the oil supply will grow fast enough to meet demand. Although total oil output is calculated to rise by only 3.2% annually in 1981-1985, if the agricultural sector gains momentum, GNP growth may well surpass this figure. Resultant increasing domestic energy demands may, at the least, force cutbacks in Soviet fuel exports.

4. Soviet oil exports to non-Communist countries are forecast to rise to 70-90 million tons by 1980, or about 5% of total OECD oil imports. There are uncertainties as regards longer-term prospects: forecasts for USSR oil exports to the West by 1985 vary from 15 to 55 million tons.

5. Within the past year, US Authorities (CIA) have forecast that for various reasons including poor oil recovery methods, lack of geological exploration, and remote, inaccessible reserves, Soviet oil output in 1980 will fail to reach

that targeted and may even peak between 1978 and 1982; by 1985, the country may well be a net importer of oil. In such an eventuality, the implications for the USSR could be wide-ranging: it would probably have to put pressure on its East European allies to turn elsewhere for some of their oil supplies; and even if the additional hard currency cost of importing oil were limited, the COMECON would likely see its trade imbalance worsen and its credit rating in the West deteriorate.

6. On the other hand, experts from the United Kingdom and France feel that, given continuing oil technology trade from the West, the 1980 Soviet target of 620-640 million tons is "feasible". They conclude that Soviet oil output in 1985 would suffer only if essential Western oil technology and "know-how" were not forthcoming. Rather than talking of an "oil crisis", some observers express the view that the USSR will suffer a general energy "crunch" by 1985 as domestic and foreign export demands threaten to outstrip available supplies.

7. Oil production in 1976 was 520 million tons and were about 550 million tons in 1977, very close to Plan target. During 1977-1980, aided by extensive purchases of Western equipment, especially submersible pumps, rapid increases in output in the West Siberian fields are planned which will compensate for declines in older fields of the Volga-Urals and North Caucasus Basin. Nevertheless, to conserve fuel and maintain export trade growth, annual increases in oil consumption have been reduced from 5.7% in 1975 to 2.8% in 1976. As a result, there could be a possible slowdown in the expansion of the chemical industries, as well as a continuing low growth in the automobile sector.

8. The Soviet oil industry faces several problems including a lack of infrastructure in the new Siberian oil fields; a lack of skilled manpower in Northern Siberia; very limited offshore drilling activity; the ongoing need for expensive Western equipment to help maintain oil output levels, and Western pipe to transport the oil to end-users; and the difficulties surrounding the extraction process itself. Long-term damage appears already to have been done as a result of a massive one-time assault in West Siberia on all extractable primary and secondary oil, leading to a high rate of water incursion.

Natural Gas

9. The Soviet natural gas industry, based on huge gas reserves of about 4 trillion m³, has grown rapidly in importance in recent years. Production in 1976 was 321 billion m³, sufficient both to meet the country's internal demands and to

provide growing quantities for export to CMEA and the West. The share of natural gas in the Soviet energy consumption balance has risen from just 9% in 1950 to almost 25% in 1975, and will almost equal oil as a major energy source by the year 1990. The 1976-1980 Plan directives, which apparently assume large Euroloans and investment, as well as delivery of enormous quantities of Western pipe and equipment to transport gas from remote fields to the West for repayment, call for an average annual growth rate of 8.5%, bringing total production to 435 billion m³ in 1980.

10. Soviet natural gas exports are consequently expected to rise. By 1985, the Soviet Union may be supplying as much as one quarter of West European gas consumption. The loss of this source of supply could be serious, particularly to those individual countries (Finland, Austria, Denmark, Italy) which may have acquired a considerable degree of dependence on Soviet energy.

Coal

11. As a result of an energy policy shift in favour of oil and gas, both coal's share in the Soviet energy balance and the average annual rate of growth in coal production has declined, despite the existence of large reserves. Output in 1976 was 712 million raw tons, only 2.9% above 1975 levels. The main issue is whether Soviet coal output can be expanded to satisfy, through expensive large-scale substitution, a substantially greater share of boiler and power station fuel demand. The very long lead times required and the capital, labour, environmental, and technical constraints, together with a continuing debate within the Soviet decision making apparatus on the use of coal versus oil, may prevent Soviet coal output from reaching even the goal of one billion tons by 1990.

Electricity

12. Total USSR electricity output in 1976 was 1,100 billion kWh, with 1980 output set at 1,340-1,380 billion kWh. Preliminary 1978 figures indicate a growth of only 4.8% over 1977, with output reaching 1,207 billion kWh(1). Nevertheless, poor equipment, inefficient management and low labour productivity could lead to unfulfilment of the 1980 goal. Until nuclear power plants relieve the pressure on overworked thermal plants, brownouts and declines in annual output growth will continue.

(1) As forecast by Baibakov, Pravda, 15th December, 1977

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Nuclear Power

13. In 1976 the Soviets possessed 6,900 MW of nuclear generating capacity out of a total COMECON figure of 8,440 MW (USA: 44,000 MW). Plans for 1980 call for 15,000 MW of new nuclear capacity, almost all in European Russia where there are shortages of fuel from local sources and where population and industry are concentrated. If the plan is achieved, nuclear power would then account for about 7% of all electricity generated. The Soviets are not deterred by environmental considerations in their nuclear programme, and until the West becomes more enthusiastic about atomic power, the USSR will remain in the forefront of planned nuclear development. In connection with its nuclear power programme, the USSR has been delivering enriched uranium to West Germany and France since 1974 and Italy since 1976, with future contracts signed by many other countries. By 1985, the USSR will play an important rôle in the nuclear power programmes of West Europe through the anticipated provision of 20% of the area's total uranium enrichment requirements. Additionally, the USSR has sold complete nuclear plants to Finland and Libya, and is fast assuming an important rôle in nuclear plant sales throughout the world.

Soviet Energy Trade

(a) Oil

14. Soviet oil exports in 1976 to Eastern Europe totalled 68.3 million tons priced at \$3.42 billion, while Western Europe purchased 56.9 million tons at a total cost of \$5.28 billion. Total 1976 Soviet oil exports reached 148.5 million tons valued at \$10.3 billion. The largest Western customer was Italy buying 11.9 million tons, while Czechoslovakia was the best CMEA customer with 17.2 million tons. Prospects for Soviet oil exports to Eastern Europe are limited. The Soviet Union has informed these countries that its 1980 exports to the area will be no more than about 80 million tons. Exports to Western Europe for vital hard currency receipts will increase only if the growth of Soviet domestic consumption can be held down and output continues to grow. If oil production peaks in the early 1980's the USSR may well become an oil importer by 1985. Prices charged to customers in both East and West will increase in line with general OPEC rises.

(b) Gas

15. Of all energy branches Soviet gas exports seem to have the healthiest future, based on long-term gas deals with both East and West Europe. Total net exports in 1976 were 14 billion m³, valued at \$752 million. As in the case of oil,

the largest customers were Czechoslovakia and Italy. The 1980 forecast calls for a net trade of 48.3 billion m³ in 1980 worth £2 billion. Sales to the West will stand at 24.8 billion m³ and represent about 25% of total Western gas consumption; a certain dependence of some West European countries on Soviet gas is, therefore, possible.

(c) Coal

16. The USSR is a net exporter of coal. Soviet coal exports to other Communist countries amounted in 1976 to 16.5 million tons, up almost 2 million tons from the 1970 level. Exports to non-Communist countries totalled 9.6 million tons, slightly below the 1970 level, and earned the USSR about \$385 million in hard currency. Prospects for greatly increased sales are slight due to increased production in the rest of CMEA and tight competition on Western markets.

(d) Electricity

17. Soviet electricity exports in 1976 to East Europe totalled 11.5 billion kWh, directed mainly to Hungary, Bulgaria and Czechoslovakia. Exports will increase somewhat when the Soviets procure the technology required to transmit high voltages on the 750 kilovolt, 1,000 km line planned between Hungary and the Ukraine.

PART II - EAST EUROPE

SUMMARY

A: OVERVIEW

18. East European dependence on imported oil is rising. Oil consumption in the non-Soviet CMEA will continue to expand from some 87 million tons in 1975 to around 115 million tons in 1980 and may reach a possible 160 million tons in 1985. Apart from Romania, East Europe obtains almost 90% of its oil from the USSR. The USSR has informed CMEA member countries that they must now seek above quota supplies elsewhere.

19. Faced by this prospect, the smaller CMEA countries are making rigorous attempts to save oil. As in the USSR, most are focusing attention on the revitalization of the coal industry and, in the longer-term, the development of nuclear power. The USSR has also successfully involved East European countries in joint energy projects, which include the Orenburg gas pipeline, a CMEA electrical grid, numerous research institutes and energy co-operation agreements.

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B. COUNTRY ANALYSIS

(a) Bulgaria

20. Completely dependent upon Soviet imports for oil, Bulgaria will have to turn eventually to OPEC and increase domestic prices because of the Soviet oil delivery cutback. To ease oil import pressures, Bulgaria has tried to develop nuclear power production. Nevertheless, the output figure of 35% of total electrical power given for 1990 seems remote unless new plants are rapidly constructed.

21. The electricity sector has maintained steady growth. In 1976, output for consumption totalled 31,204 billion kWh, 8.1% above 1975. Gross per capita consumption reached 3,570 kWh. The 1980 goals are: installed electric power capacity, 9,530 MW; total production, 39 billion kWh; imports, mainly from the Soviet Union, 5 billion kWh, or 10-12% of total consumption. Bulgaria relies on thermal plants for 46% of its electricity capacity. Low calorie coal output is to increase from 27 million tons in 1975 to 39 million tons in 1980, helped partially by the construction of the largest underground brown coal mine in the Balkans.

(b) Czechoslovakia

22. In Czechoslovakia, the present expansion rate of electrical energy output is trailing domestic demand growth. Reserves of coal and lignite, which provide 70% of Czechoslovakia's primary energy, are dwindling. The Government has undertaken strict energy conservation measures in the face of widespread wastage, but with little apparent success.

23. To supplement coal reserves as a source of electrical power production, Czechoslovak planners count on steadily increasing nuclear power generating capacity, based on the country's reserves of high-grade uranium. Nevertheless, by 1980 coal-powered plants will still be generating four-fifths of Czechoslovak electricity production, and nuclear only 3.8%. Much work will have to be done to reach the nuclear power share of 33% targeted for 1990.

(c) East Germany

24. The energy and fuel sector is still one of the bottlenecks of the German economy. Since 1960, the yearly rate of increase in gross output has averaged 3.2%, about half the expansion rate of industry as a whole (6.1%). Labour productivity in the energy sector has been low, registering only 1.5% in 1971-1975 (industry as a whole: 5.3%). Other problems

include: exhaustion of open-cast mines, insufficient modern plant and equipment, and steadily increasing costs of lignite extraction. As a result, electricity supply has failed to meet industrial demand and cannot do so before 1980. Little help is forthcoming from nuclear power (the GDR has only one station), as the authorities have decided against a fully implemented nuclear programme for the time being. Most of the GDR's oil imports (17 million tons in 1975) come from the USSR.

(d) Hungary

25. The continuing rise in the cost of imported raw materials and energy both from the Soviet Union and the West at deteriorating terms of trade, plus a domestic energy demand growing by 3-4% a year, has led the Government to expand domestic production of fuel and power. Great store is put on natural gas output, which in 1976 reached 6.2 billion m³, with Soviet imports adding over one billion m³. Nonetheless, Hungary will increasingly rely upon imported energy and is participating in the new \$500 million Adria oil pipeline running from the Adriatic which should add an additional annual capacity of 5 million tons to the existing domestic system.

26. In the electric power sector imports from the Soviet Union through the CMEA grid will be 7.5 billion kWh in 1980, or about 22% of the Hungarian total output. Hungary's first nuclear reactors, constructed with Soviet help, come on stream in the early 1980s and will provide 10% of total energy output.

(e) Poland

27. Poland's energy supply is on the whole acceptable and able to meet both domestic and export demands, though it still has to confront problems caused by considerable waste, underfinancing and relatively low productivity levels. Poland is the world's fourth largest producer of hard coal, which provides Poland with its chief source of primary energy (78.6%) and almost 20% of its export earnings.

28. Like most of her East European neighbours, Poland relies almost toally on the Soviet Union for oil supplies. It seems highly unlikely that any major discoveries will be made either in Poland or in the USSR where Soviet-Polish exploration projects are nevertheless in progress. Poland may, therefore, be forced to cut back on the planned expansion of her oil-processing and petrochemical industries.

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(f) Romania

29. Romania's anticipated energy independence during the period 1977-1980 is based more on gas than oil. The country is now the sixth largest producer of natural gas in the world. Romania has stepped up its coal output and in addition has recently passed a number of severe energy conservation measures. There is presently little activity in the nuclear field, nor do medium-term plans call for a massive switch to nuclear power.

30. Romania's oil output is peaking, with production at 14-15 million tons a year. At present Romania imports oil from Iran and Libya to supplement refinery output for export, but will need to at least double output by 1980 to meet ambitious industrial growth targets. Exports of oil and oil products are forecast to reach 17 million tons in 1980 and net \$1.5 billion, the largest source of hard currency in Romanian trade. The 1977 earthquake, however, severely damaged about one-third of the Ploesti oil complex and might result in significant slowdown in oil refining.

MAIN REPORT

PART I - THE SOVIET UNION

A. SOVIET ENERGY: AN OVERVIEW

1. The Soviet Union's production of oil and coal is the largest in the world and its extraction of natural gas is second only to that of the USA. In addition, the USSR is richly endowed with all conventional sources of fossil energy, but the importance of the traditional producing areas is declining and overall growth rates are falling. To compensate for the depletion of older reserves and to provide for future growth Soviet fuel industries are having to move to regions which are remote from the consuming areas and subject to harsh climatic conditions. Moreover, the geology of the new oil fields makes the extraction more difficult and costly.

2. Consequently, attempts are being made to bring the growth of energy consumption into line with the declining growth rates in production. In the past, oil and natural gas have contributed the bulk of the increase in both energy production and consumption and thus the share of hydrocarbons in the energy balance has increased steadily. Efforts are being made to slow down the growth trend, particularly with respect to oil. Thus oil consumption is expected to increase by only 4.5-5% a year up to 1980 and to level out at about 38-39% of the energy balance in the next decade. Natural gas is continuing to increase its share of the total energy consumption to form about 26% by 1980 and may replace oil as the largest single source of energy by 1990.

3. In the short-term, until 1980, the impact of Western technology equipment upon current Soviet production techniques will permit the Soviet Union's energy production to rise at 5% a year - a rate sufficient to meet all domestic and export demands. Total Soviet energy production is forecast to rise to 2,058 million tons SFE(1) in 1980 from the 1975 figure of 1611.7 million tons. In the longer-term (1980-1985) energy production will increase 3.2% a year or equal to the average GNP growth in 1981-1985 and, at that time, hold in the range of 2,125-2,372 million tons SFE(2) depending upon varying Western assessments of Soviet oil production capabilities. If, as the CIA suggests, Soviet oil production is shortly going to peak, the impact of such a stagnation or negative oil output

(1) Standard Fuel Equivalent. For method of calculation see AC/127-D/559, from which these figures derive.

(2) French forecasts for 1980 are roughly similar as are US figures, apart from the latter's controversial view on oil output predictions with which this paper deals with in paragraph 4.

growth will have an adverse effect on GNP growth in the next decade; in turn this would give rise to a host of accompanying problems such as import financing difficulties. On the other hand, if Soviet oil output forecasts are reached, growth patterns will be relatively stable though low (3-4%), because of the well-known other obstacles affecting the Soviet economy (poor agricultural performance, supply bottlenecks, lack of reform, etc). The present paper, however, is based on the assumption that Soviet production of natural gas, peat/shale and hydroelectric power will not encounter any major difficulties in the early 1980s and will meet planned targets, provided there is substantial improvement in infrastructure in Sineria as well as continued availability and infusion of huge amounts of Western technology.

B. SECTORAL ANALYSIS

(a) Background to the Great Oil Debate

4. The Soviet oil industry has recently attracted great interest. This is due mainly to the spring 1977 CIA forecast that, for reasons including poor oil recovery methods and lack of geological exploration, Soviet oil production could peak as early as 1978 and certainly not later than 1982, and by 1985 the country may well be a net importer of oil(1). According to this forecast, Soviet oil output in 1980 will probably be in the range of 550-590 million tons, considerably less than Soviet predictions. If this does occur, the implications for the USSR could be wide-ranging: pressure will be put on its East European allies to take less Soviet oil and turn elsewhere for their supplies; the increased hard currency cost of importing oil would, even if limited, add to the USSR's trade imbalance and impair its credit rating in the West.

5. On the other hand, experts from the United Kingdom, Germany and France feel that the 1980 target of 620-640 million tons is "feasible" with an annual growth of 1-1.7% a year in the 1980-1985 period. Moreover, they feel that there should be no insurmountable difficulties in oil technology, given continued trade with the West and continued production of domestic pumps until 1985. Finally, the Soviets themselves in March 1976 raised the 1980 target from 620 to 640 million tons and gave no indication of a significant downturn in the 1980 and 1985 oil output objectives, but they have reduced their previously announced 1990 goal of one billion tons in light of the undetermined potential of oil in East Siberia and the Far East(2).

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- (1) Admiral Turner's testimony at the Froomire hearings, 23.6.77.
(2) It is argued that the difficulties predicted by the US imply such drastic and, for the USSR, undesirable changes in East-West economic relations, that the USSR would be willing to make additional investment funds available to the oil industry if there were any signs of a reduction in production. It thus appears realistic to expect a stable growth of production for the period up to 1985, supplying sufficient quantities of oil for the Soviet Union and other COMECON countries, as well as possible decreasing quantities to the West.

(b) Oil Production

6. The Soviet Union in 1976 was the world's largest producer of oil, with 520 million tons. Its reserves, while admittedly classified as a state secret, are estimated by Western observers to be anywhere from 7-12 billion tons (USA: 5.4 billion tons; Saudi Arabia: 23 billion tons)(1) with 6.5 million tons still to be extracted in Western Siberia. During 1977-1980 increased output in the West Siberian fields should not only compensate for the decline in older fields of the Volga-Urals and North Caucasus basin but should enable total production to grow 5% annually (1971-1975: 6.7%) to reach the forecast 575 million tons in 1978 and at best 620 million tons in 1980. In anticipation of continued growth in West Siberian output, the Soviets are now building a 4,000 km pipeline from the Samotlor fields to European USSR (due for completion in 1979).

7. This emphasis on the rapid development of West Siberian oil should raise its share of total oil output to 300 million tons in 1980, largely as the result of extensive use of Western equipment, especially submersible pumps(2). The main field, Samotlor, contributed three-fifths of West Siberian output (128 million tons) in 1977 or 21% of the overall total(3). This field will produce about 140 million tons yearly from 1980 to about 1985. While the water content of the Samotlor field is about 50%, the field is still in its first stage with only 25% of the wells mechanized. Advanced stages with fuller mechanization will probably allow the field to hold its peak for several years(4). In addition, 50% of the Samotlor wells need at least 10 years for development; given that this field came on stream in 1969-1970, it is probable that the peaking would start in 1979-1980(5).

(c) Oil Consumption

8. Oil consumption increase for 1976-1980 is set at 5% yearly. Consumption estimates for 1980 are 470 million tons (1975: 368 million tons) and 670 million tons in 1985, or 3.9% annual growth from 1981-1985. One of the consequences of this reduced growth will be a possible slowdown in the expansion of the chemical industries, as well as little further progress in

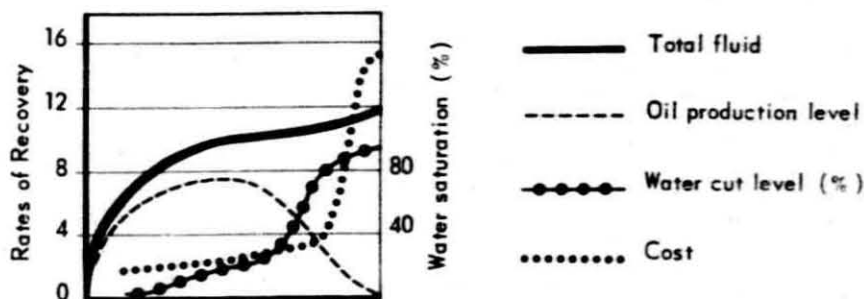
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- (1) CIA, Handbook of Economic Statistics 1976, Washington, 1976, p. 78; International Herald Tribune, 13th December, 1977, p. 1, based on a recent US Geological Survey.
- (2) V.P. Maximov, Exploitation of Petroleum Deposits in Complex Conditions, (M. 1976), translated in JPRS, L77572, p. 1. Submersible pumps, centrifugal electric pumps extracted about 130 million tons of petroleum a year or 25% of 1975 total.
- (3) 1977 output in Sovetskaya Rossiya, 13.10.77, p.1. Samotlor is running at 2.5 m. tons above plan and about 5% above "its production potential", estimated by E. Jack et. al., "Outlook for Soviet Energy" in Joint Economic Committee ed., Soviet Economy in a New Perspective, (Washington 1976), p.461.
- (4) Maximov, op. cit., p. 29
- (5) Ibid., p. 28

the presently small (3%) growth rate in the automobile sector. Whether the consumption savings can be transferred to the export sector is a different matter, given the enormous wastage in the Soviet system. It would seem that only a thorough reform of the economic structure would permit any savings to make a real contribution to the economy.

9. The Soviet oil industry continues to be faced with severe problems including the replacement of the Soviet Oil Minister Shashin, who had proved to be competent during the 1971-1975 Five-Year Plan, and the Head of the West Siberian oil sector, both of whom recently died. Other factors include the lack of infrastructure and proper geophysical equipment in many of the new West Siberian oil fields; this shortage will be exacerbated as oil exploitation moves eastwards in the last 1980s; also, the problem of attracting skilled manpower to Northern Siberia is aggravated by the lack of accommodations suitable for harsh northern conditions. The Soviets have proposed that the area be operated by a highly mobile labour force which would commute between their homes and the oil/gas sites. Several years, however, are needed to implement any current planning in this direction. Another problem concerns the very limited offshore drilling activity and output. Even if it were developed more quickly, little would be produced until the late 1980s; additionally, account should be taken of the ongoing need for Western equipment to help maintain oil output levels and Western pipes to transport the oil thousands of kilometers to end-users, as well as the difficulties surrounding the extraction process. Long-term damage appears already to have been done as a result of a massive one-time assault in West Siberia on all extractable primary and secondary oil, leading to a high rate of water incursion - faster than was the case in the Volga fields(1). An adverse consequence has been the rise of overhead expenses of 5-10% above the production cost in an effort to combat water saturation(2).

- (1) The Soviets claim that the necessity of maintaining stratum pressure from the very outset of development is due to the "high recovery rates and the peculiarities of the structure of ... the petroleum beds". Maximov, *op. cit.*, p. 25.
- (2) V.P. Maximov, Exploitation of Petroleum Deposits in Complex Conditions, (M. 1976), translated in JPRS L/7372, p. 44, Fig. 1 refers to wells in the Ural-Povolzh'ye region. On water problems in general, see CIA, Prospects for Soviet Oil Production.

FIG. 1



Total recovery of petroleum (Ural-Povolzh'ye region).

At the same time, the Soviets acknowledge that the geological exploitation and reserves to production ratio has declined as a result of the rapid growth of extraction during the early 1970s, and that this trend will have to be reversed in the 1980s to ensure fulfilment of long-range goals. Even when oil is discovered the time lag between discovery and normal production is several years (e.g. Sakhalin, where the time required to arrange Japanese participation, start drilling and achieve maximum production is likely to be about 5-8 years).

C. NATURAL GAS

(a) Background

10. The USSR claimed, in 1974, to possess explored (i.e. proved and probable) reserves of the order of 28.6 trillion m³ with an additional 12 trillion m³ classified as promising. However, over 80% lie in Siberia, the Arctic, Central Asia and Kazakhstan, where climate, terrain and remoteness from the main consuming centres of European Russia lead to costly development(1). Nevertheless, the Soviet natural gas industry has grown rapidly in importance in recent years. Production in 1976 was 321 billion m³ (1977 target: 342 billion m³), which was sufficient to meet the internal demands of the country and make available growing quantities for export to CMEA and the West.

(b) Production

11. According to the Tenth Five-Year Plan (1976-1980) directives, the natural gas industry is to achieve an average annual growth rate of 8.5%, bringing total production to 435 billion m³ in 1980. This rate will fall to about 8% in 1981-1985. The West Siberian lowlands in particular will have to contribute almost four-fifths of increments in Soviet gas output until 1980 and 100% of net gains in output after that, as production will cease elsewhere. The greatest increases will occur after 1977 at the Medvezhye and Urengoy fields and in the Tyumen' oblast of West Siberia, where production is to grow by 32.7% per annum from the 34 billion m³ in 1975 to 140 billion m³ in 1980, or about 30% of total production.

12. Attainment of the highly ambitious 1990 target of 900 billion m³ would call for an additional 100 billion m³ of production in West Siberia every 2-3 years. This would require the industry to procure for West Siberia alone an annual 32 million tons of rolled steel (one-third of present capacity), 300,000 tons of non-ferrous metals, and 25 million tons of

(1) MOJ, Intelligence Digest No. 653, June 1976. US reserves as of January, 1977 are 216 trillion cu. ft. (Oil and Gas Journal, 6th June, 1977).

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cement (one-fifth of present capacity which is growing only at the slow pace of 3% a year). Imports would help, but the cost would be staggering(1) and would be opposed by other energy interest groups. West Siberian interests would certainly clash with those officials and interests presently pushing for all-out development of the Kansk-Achinsk coal basin (see Section D).

13. Assisted by large Euroloans and investment (estimated at \$3.6 billion in 1976) and delivery of enormous quantities of pipe and equipment provided by both East and West in exchange for future fuel deliveries, the gas industry is growing far faster than the national economy as a whole: production in 1976 increased 10.8% (oil: 5.9%, industrial output: 4.8%) and January-October 1977 figures show a further rise of 8%. The share of natural gas among Soviet energy sources has risen from just 9% in 1950 to almost 25% in 1975, and will almost equal oil as the major energy source by the year 1990.

(c) Gas Pipeline

14. Pipeline construction for both gas and oil is extremely expensive (quite apart from the cost of infrastructure in West Siberia where, for example, road costs alone are estimated to be 1.1-1.6 million rubles per kilometer). To reach the 1980 target of a net increase of 224 billion m³ (of which West Siberia is to deliver 139 billion m³) the gas will have to be piped from the Asiatic to the European USSR (see Map, Annex II). Present pipeline capacities permit the transport of roughly half of this amount. In addition, with present technology, gas pipelines transmit fuel with only about one-fifth of the calorific value of that which can be carried by an oil pipeline of the same diameter; improved technology (Liquid Natural Gas or radical cooling) is not planned in the early 1980s. The 1976-1980 Plan calls for construction of 36,500 kms of new gas pipelines and purchase of 300 new compressor stations with a network total of about 110,000 kms by the end of 1977(2). In 1979 the production of Soviet welded multi-layered large diameter pipe will start at the Vyksunskiy metallurgical plant (capacity in 1981: one million tons of pipe annually). The output is intended to lessen the country's dependence upon Western pipe supplies. Nevertheless, as a result of the vast geographical problems, gas deliveries will probably not increase as spectacularly as planned.

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- (1) L. Dienes, "The Soviet Union: An Energy Crunch Ahead?", Problems of Communism, September/October 1977, p. 49.
- (2) Ekonomicheskaya gazeta, No. 6, February 1976. Over 120 GE stations have been bought at a cost of \$6 billion. Business Week, 17th October, 1977. Since 1974, the Soviet Union has already purchased more gas transmission equipment than the rest of the world together.

D. COAL

15. Soviet geologists estimate the USSR's recoverable reserves of coal to be about 140 billion tons, or 200 times the 1975 output; total geological reserves exceed 6 trillion tons. However, three-fourths of the Soviet proved reserves are located in its Eastern regions, far from the main energy consuming centres in European USSR, and they include substantial amounts of low-grade brown coal. Coal production stood at 712 million raw tons in 1976, 2.9% above 1975 levels, and this growth rate has declined to about 2% in 1977. If this decline continues, the 1980 output may well fall short of the targeted 805 million tons. The 1990 goal is one billion tons, and appears to be a most difficult task for the coal industry to achieve.

16. During 1976-1980 the main centres of planned production increases will be the strip-mine in the Western Asiatic regions bordering the Trans-Siberian railroad: the Ekibastuz coal deposit in the Kazakh SSR, the Kuznetsk Basin in West Siberia, and the Kansk-Achinsk Basin in East Siberia. Output in the Donets Basin in the Ukraine, where mining costs are relatively high, is to increase only slightly.

17. Coal's share in the Soviet energy balance has been declining steadily - from 53% in 1960 to 32% in 1975 and a projected 30% in 1980 - as oil and gas have substantially replaced it in many applications in industry, transport, and the household-communal sector. However, since the sharp increase in world oil prices in 1973, Soviet pronouncements have stressed the use of coal in power plants and the decline in coal's share in fuel used in thermal plants appears to have bottomed out; its share is scheduled to rise slightly from 44% in 1975 to 46% in 1980. Nevertheless, the main issues confronting Soviet energy is whether large-scale coal substitution for oil/gas can take place and, if so, whether Soviet coal production can satisfy a substantially greater share of boiler-fuel demand. The best test might be the planned construction in Eastern Siberia of four large on-site power plants to burn Ekibastuz coal as well as the creation at Kansk-Achinsk of a giant fuel-energy complex using lignite. Both would hook into a proposed 1,500 KV DC trunkline to Tambov (south-east of Moscow). Major success could be forthcoming if technology can solve the problem of transmission over distances of 1,000 miles, if large capacity, long-distance coal slurry transport is developed, and if large-scale enrichment of the poor quality Kansk-Achinsk lignites with corresponding capital expenditure of up to 20 billion rubles (\$27.6 billion) is put in motion(1).

(1) This investment, spread over 1977-1990, would equal the fixed assets value of the oil and gas industry in 1976. Cf. Dienes, p. 56.

18. Full scale commitment to developing coal mining sites is unlikely to happen before the early 1980s. Such a delay would be due to the very long lead times required and the capital, labour, environment, technical constraints, together with the on-going coal versus oil controversy within the Soviet decision-making apparatus. These problems may prevent Soviet coal output from even reaching one billion tons by 1990. In short, any restructuring of the energy balance to lessen the reliance on hydrocarbons will be very difficult and costly, and it would presumably take a serious and immediate short-fall in oil production targets, as well as a poor performance in nuclear development, to activate the huge coal-processing complexes proposed for Siberia.

E. ELECTRICITY

19. Total USSR electricity generated in 1976 was 1,100 billion kWh; 937 billion kWh were generated in January-October 1977, 4% more than the 1976 10-month level, of which about 85% came from thermal plants. The 1978 forecast calls for a 4.8% growth over 1977 to 1.207 billion kWh. The 1980 Plan calls for the introduction of 70,000 MW new capacity, including 15,000 MW of atomic power, to raise total annual electricity production to 1,340-1,380 billion kWh. Great efforts are to be made to form a unified USSR power grid by linking Siberia's cheap electric power at Ekibastuz with the western regions, and further development is anticipated of Soviet electricity exports to East Europe via the CMEA "Mir" grid.

20. Electricity's share of the energy balance has remained steady in the last eight years and represents about 15-16% of the total(1). The 1976-1980 annual growth rate is set at 4.8%, one of the lowest in CMEA, and reflects the need to improve mechanization and management. Soviet plants frequently run far below capacity due to on-going repair work; domestic steam turbo-generators and boilers are described as inferior in generator cooling, efficiency and reliability. More serious is the poor labour productivity record. The January-October 1977 figures indicate a productivity growth in output of only 1% over 1976 and are far below the general industrial average of 4.3%(2). Until the nuclear power plants come on stream and relieve the pressure on overworked thermal plants, overloaded generating stations are likely to remain unable to meet peak demands, leading to unexpected output decreases at various times.

(1) Annex II, AC/127-D/559, p. 3. (1970: 15.3 million tons SFE; 1975: 15.5 million tons SFE).

(2) Ekonomicheskaya gazeta, No. 47, November, 1977, p. 4

F. NUCLEAR POWER

21. In 1976, the Soviets had 16 operating nuclear power reactors with 6,900 MW of nuclear generating capacity out of a total COMECON figure of 8,440 MW (USA: 44,000 MW), and an additional 12 reactors under construction. By 1980, plans call for 15,000 MW of new nuclear capacity(1), almost all in European Russia where shortages of fuel from local sources and the concentration of population and industry have resulted in frequently tight supplies of energy. If this goal is met, nuclear power will, in 1980, account for about 7% of all electricity generated (1977: 3%; USA: 10%). To equip the expanding nuclear industry in both the USSR and East Europe, a reactor-manufacturing complex (Atomash) is slowly being built at Volgodonsk to manufacture three to four 1,000 MW reactors a year. These will be conventional steam-generating heavy-water types, whose power production costs are about 30% below those of the standard 440 MW units, now also constructed both in the USSR and Eastern Europe. Advanced fusion reactors (type TOKAMAK) are still, in Soviet eyes, at least a decade away from being commercially feasible. Fast breeder reactors, of which a prototype is now being built, are still highly uneconomical.

22. In none of the above plans are there any references to environmental hazards or possible public opposition. Additionally, it appears that the Volgodonsk delays, due to the traditional Soviet slowness of transmitting R&D into practical results, will substantially limit the 1980 planned capacity, and cause further pressure on the already overworked electricity supply sources. A more serious obstacle for Soviet nuclear development arises from the Soviet nuclear-technical monopoly in the Warsaw Pact bloc. Despite the ostensibly joint consultative process at the Dubna nuclear research centre and Interatomenergo (established in 1973), the USSR has resolutely prevented the establishment of any independent national nuclear-technical industry. With the exception of a heavy-water reactor project in Czechoslovakia, which can be considered a failure, all reactor types used in Eastern Europe have been developed and built in the USSR. Research, development and production capabilities, as well as systematic contact with Western research in the field remain limited. Nevertheless, until the West becomes more enthusiastic about atomic power, the USSR will remain in the forefront of planned nuclear development(2).

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- (1) Announced by the Minister for Electricity Neporozhnil, Elektricheskiye stantsii, No. 8, August 1977, pp. 2-9.
- (2) As an example of western caution, not ostensibly found in COMECON, various European parliamentary reports have recommended that there should be no commitment to a large programme of nuclear fission power until safe containment of long-life highly radioactive waste is found. See North Atlantic Assembly, Report on Nuclear Energy, T149 STC(76)11, p. 4.

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G. CONCLUSIONS

23. Despite the apparent high growth rates for the oil and gas industry there are considerable problems ahead. In general, technology, investment resources, and infrastructure development have not been keeping pace with the leadership's long-range energy exploration and extraction plans. The Soviets will need to continue importing large quantities of Western technology for the rapid development of energy resources. Whether this trade will be accelerated will depend upon the Soviet ability to earn hard currency, borrow at acceptable interest rates and arrange compensation agreements.

H. SOVIET ENERGY TRADE

(a) Oil

24. Total Soviet oil exports in 1976 increased by 18.1 million tons to 148.5 million tons, worth \$10.3 billion, with price increases in 1978 averaging 20% per ton.

But in the current Five-Year Plan period, Soviet oil supplies to the COMECON countries will increase only half as rapidly (+4.8% per year) as during the last Plan cycle (+9.5%). The relative decline in oil deliveries will be compensated only partly by a strong annual increase (17%) of natural gas and supplies. In any case, Soviet oil deliveries represent a heavy financial burden for the East European countries, although Soviet oil price increases have not yet reached world market levels because of COMECON price-fixing principles based on a five year moving average.

East Europe (without Romania): Imports
of oil and oil-products by origin(1)

	<u>Total</u> <u>Mill. t</u>	<u>From USSR</u> <u>Mill. t</u>	<u>USSR's Share</u> <u>%</u>
1970	40.0	40.2	91
1973	64.8	55.3	85
1974	66.6	58.8	88
1975	72.2	63.3	88
1980	91.0	78.0	

(1) J. Bethkenhagen, "Joint Energy Projects and their influence on Future COMECON Energy Autarchy Ambitions", NATO (1977 Colloquium) ed., COMECON: Progress and Prospects, (Brussels 1977), p. 42.

25. Nonetheless, Soviet oil price rises have provided the USSR with substantial additional income. Its export revenues from all energy supplies to the COMECON countries increased from 1.5 billion transferable rubles (\$2.1 billion) in 1975, to 3.2 billion transferable rubles (\$4.4 billion) in 1976 (\$3,780 million for oil, \$582 million for gas)(1). In 1975, the additional proceeds from price increases alone (1.4 billion transferable rubles), for instance, were equal to total Soviet imports from Hungary during the same year.

26. Soviet oil exports to Western Europe in 1976 stood at 56.9 million tons, worth about \$5.28 billion total (see Table 2). As this Table indicates, the leading Western buyer was Italy (11.98 million tons, worth \$1.05 billion, representing a 57% increase in volume over 1975). Despite rapid growth in oil exports to the West, the USSR does not have an oil surplus sufficiently great to enable it to flood and disrupt world markets even if it ignored the strong commercial reasons against so doing. The Soviet Union also increased its exports of oil to most other Western countries and will probably continue to do so over the next 2-3 years, as the Soviets are anxious to gain as much hard currency as possible. Moreover, it is possible that in the post-1980 period, the Soviets will have to choose among the conflicting claims of Eastern Europe, the West and domestic needs upon their oil resources.

(b) Gas

27. The Soviet gas trade has a healthy future. Total exports in 1976 were 25.7 billion m³, worth \$990 million(2). Subtracting gas imports of 11.7 billion m³ from Iran and Afganistan worth \$237.6 million, net gas exports were 14 billion m³, valued at \$752 million. The largest Eastern customer was Czechoslovakia with 4.2 billion m³ (\$200 million) (see Annex I, Table 3) while Italy was the largest Western buyer with 3.7 billion m³ (\$70 million). Net exports to the West are forecast to rise to 48.8 billion m³ in 1980 or 13% of total output. Western Europe (FRG, France, Italy and Austria) in 1980 will buy about 24 billion m³, or 9% of the total natural gas consumption of Western Europe. At \$68-88 per 1,000 m³, the purchases will come to almost \$2 billion; most of this gas will be paid for in the form of large diameter pipe exports to the USSR. Longer-term forecasts indicate that by 1985, the USSR may be supplying as much as one quarter of West European gas consumption. A certain degree of vulnerability may be seen in those countries (Italy, Finland, Denmark, Austria) which will be more dependent on Soviet

(1) Oil and Gas Journal, 15th August, 1977

(2) At \$1.09 Mcf up 22% from \$.893 Mcf. Oil and Gas Journal, 15th August, 1977, p. 30

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energy. Exports to Eastern Europe are also to rise, partially paralleling Soviet intentions to direct its oil trade more towards the West for hard currency. Latest figures available indicate that Soviet sales in Eastern Europe in 1976 were 13.4 billion m³; they are forecast to climb to 24.8 billion m³ in 1980. Part of the reason for this rapid expansion of East European imports is the cheapness of gas as compared to oil. Natural gas in 1976, \$38.50 per 1,000 m³, or 46% of the cost of oil (on average: \$84.36 per ton). As the heating value is almost the same (10,000 Kcal), it is obviously in the interests of East Europe to shift fuel requirements from oil to gas (and coal if costs are not prohibitive).

(c) Coal

28. The USSR is a net exporter of coal. Exports to Communist countries amounted to 16.5 million tons, up almost 2 million tons from the 1970 level. Exports to non-Communist countries totalled 9.6 million tons, slightly below the 1970 level, and earned the USSR about \$385 million in hard currency (1970: \$92 million), equal to 12% of hard currency earnings from oil sales. Future sales to Western Europe are likely to remain small. Imports were confined to 10 million tons from Poland. Exports to hard currency areas are scheduled to increase by 5-6 million tons per year during the 1980s as a result of a long-term agreement with Japan to share in the exploitation of coal reserves in the southern Yakutsk Basin.

(d) Electricity

29. Soviet electricity exports to East Europe are carried on the "Peace" (Mir) grid. In 1976, they totalled 11.5 billion kwt, with most going to Hungary, Bulgaria and Czechoslovakia. Further exports will take place when the Soviets have procured the technology required to transmit the high voltage (750 KV) on the 1,000 km line planned between Albertisa (Hungary) and Vinnitsa (Ukraine). Exports to the West have been directed mainly to Finland with additional supplies to be generated by two Soviet-built and serviced nuclear reactors, but projects to direct some exports to Austria are also under way. In addition, the USSR has been delivering enriched uranium to West Germany and France since 1974 and Italy since 1976, with future contracts signed for many other countries. Annual trade volume is estimated at 1.1-5 SWU (separative work units) worth about \$100 million. Soviet uranium capacity is put at 3 million SWU per year (USA: 18 million SWU)(1). Soviet and French

(1) OECD, "Soviet Energy", EP(77)7, p. 17. Soviet uranium output in 1976 was about 4,500 tons and that of East Europe 9,500 tons or 38.9% of the world's production. AC/127-WP/546.

specialists are also implementing a joint nuclear programme including an exchange of technical documentation of fast neutron power reactors.

30. The USSR and France have concluded three long-term agreements (to 1990) for the enrichment of French uranium at Soviet enterprises for use as atomic power station fuel. In this regard the USSR meets about 20% of Western Europe's total uranium enrichment requirements, including 100% of Finland's and 40% of West Germany's(1). The USSR is also planning to sell nuclear plants to Third World countries. It is now negotiating with Cuba and announcement of Libya's decision to have the Soviet Union and Finland construct a \$330 million 440 MW "Loviisa" nuclear plant was made in December 1977(2). Therman plants have already been set up in Egypt, Syria, Afganistan, Morocco and Pakistan(3).

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- (1) UK Delegation, "Possible Soviet Influence on World Energy Markets", (November, 1977), Appendix F.
(2) International Herald Tribune, 13th December, 1977
(3) Vneshnaya torgovlia, No. 7, 1977, pp. 11-18

PART II - EAST EUROPE

OVERVIEW

31. Eastern Europe is entering a critical period in its energy sector: the unit cost of energy imports increases each year while, at the same time, the share of domestic production in total consumption is falling. CMEA members rely, apart from Romania, to a greater or lesser extent on imported oil, and this dependence is rising as most East European countries are trying to direct their future economic growth towards heavy machinery, fertilizers, chemicals, synthetic textiles, etc., which are heavy energy users. When the USSR was willing to meet nearly all of their import needs, this caused comparatively little concern as Soviet oil was cheaper than OPEC oil. However, in 1975 the USSR established a price structure based on a five-year moving average eventually to bring Soviet export oil prices to CMEA into line with world market prices. It has also informed CMEA member countries that they must seek above quota supplies elsewhere.

32. Faced by this prospect, rigorous attempts to save oil are being made throughout the smaller CMEA countries. As in the USSR, attention is being focussed on the revitalisation of the coal industry, while longer term plans call for nuclear power development. However, the degree of substitution possible in the 1977 to 1985 period is limited and the best Bulgaria, Czechoslovakia, the GDR and Hungary can do is to slow down coal's decline in the energy balance. Romania and Poland are encouraging coal production to increase its share in the energy balance. Throughout East Europe as a whole increases in annual coal production to 1980 are being stepped up from 1.7-2.7%. In the case of oil, Hungary and Czechoslovakia may be able to curtail any appreciable rise of oil in their respective energy balances, but the GDR in particular, Poland and Bulgaria will see oil's position in the energy balance rising at rates close to or above that of 1971-1975: part of this is due to "chemicalization" in each country's economic plans.

33. Estimated overall oil consumption in East Europe will continue to expand from some 87 million tons in 1975 to around 115 million tons in 1980, of which the USSR will supply about 80 million tons(1). Revised plans for 1980, based on changes in refinery capacity, indicate that East Europe will import about 13 million tons from the Middle East. Added to domestic production of about 14-15 million tons, plus Soviet imports of 80 million tons, the total of 107-108 million tons will leave a shortfall of about 7 million tons, which could in some instances be filled by domestic natural gas exploitation ongoing in Bulgaria, Hungary, Czechoslovakia and Romania.

(1) AC/127-D/559, p.11

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34. As a result of the growing dependence on Soviet oil and gas, the Soviet Union has persuaded East European countries to participate in the expensive development of Soviet energy resources. The Soviet Union, however, is not willing to carry the growing energy investment costs alone. According to Soviet data, past investments (including transport costs) to ensure the export growth of oil and natural gas to the COMECON countries from 1960 to 1975 amounted to about 7.5 billion rubles, i.e. 7% of overall Soviet investments during this period. About one-sixth of this sum (1.2 billion rubles) was provided by the East European countries in the form of investment credits. Recently these countries have gone onto the Eurodollar market to obtain much of the \$600 million needed to finance the Orenburg gas pipeline.

35. Although East European planners seem to be aware of the energy problems facing each country, not all the countries have been able to make the necessary changes. For example, Bulgaria, Czechoslovakia, Hungary and the GDR have only negative or marginal increases in annual energy production output (1971-1975 average: 0.02%)(1), though their annual consumption rates (1971-1975: 3.3%) are considerably more. For Romania, although production has risen, consumption has outgrown this increase. Only Poland, thanks to its massive reliance on coal, has managed to preserve some balance between production and consumption increases (1971-1975: 3.4% and 4.8% respectively).

COUNTRY ANALYSIS

A. BULGARIA

36. Bulgarian energy development has remained very uneven. From an average annual production growth of 9% in 1960-1965 (East Europe average: 1.3%), it fell to -1.5% in 1971-1975, the lowest in COMECON(2). On the other hand, yearly consumption growth figures were somewhat higher and averaged 4.8% in 1971-1975 (COMECON: 3.8%).

37. Bulgaria has been completely dependent upon Soviet imports for oil and natural gas. However, the current Soviet oil shortage has restricted exports to Bulgaria to 10 million tons a year, down from 14 million tons in 1975 and this will force Bulgaria to turn eventually to OPEC; as a result, domestic prices have already begun to rise. In October, 1977, the government already boosted petrol prices by up to 52% in an effort to restrict car usage to a minimum. The only hope for a major oil discovery to ease import pressures lies in offshore

(1) AC/127-D/559, Annex III, p.3

(2) AC/127-D/559, Annex III, p.3

exploration. Bulgaria will begin Black Sea test drilling in 1979, but production should not occur before the mid-1980s. Natural gas output is small (.11 billion m³) or only 9% of the consumption figure of 1.29 billion m³(1).

38. The electricity sector has maintained steady growth. In 1976, output totalled 31,204 billion kWh, 8.1% above 1975. Gross per capita consumption reached 3,570 kWh(2). The 1980 goals are: overall consumption, 44 billion kWh; installed electric power capacity, 9,530 MW; energy production, 39 billion kWh; imports, mainly from the Soviet Union, represent 10-12% of total consumption(3). Bulgaria relies mainly on thermal plants for 46% of its electricity capacity. Low calorie coal output is to increase from 27 million tons in 1975 to 39 million tons in 1980, helped partially by the construction of the largest underground brown coal mine in the Balkans.

39. Nuclear power production totalled 880 MW or 8.8% of total energy in 1976, with another 880 MW presently being added to the system. By 1980, however, nuclear power will not reach 25% of total output as predicted but will remain at about 8-10%. Thus the output figure of 35% of total electrical power increase given for 1990 seems rather remote unless new plants are rapidly constructed.

40. There are ongoing problems, although none is considered potentially critical: these include the low heat efficiency of coal due to its poor quality, the fact that 20% of all thermal plants are usually out of operation(4), the lack of sophisticated mining machinery and the unsatisfactory condition of the national grid facilities which has resulted in power cuts and poor power distribution. Presumably, the creation of a National Energy Complex in July, 1977 to encourage "effective utilization, control and co-ordination" of energy measures will help alleviate some of these problems.

B. CZECHOSLOVAKIA

41. Czechoslovakia faces a growing energy shortage. Reserves of coal and lignite, the backbone of the country's energy supply, which provide 70% of Czechoslovakia's primary energy, are dwindling and require imports in increasing quantities. Czechoslovakia currently imports a net of around 400 million Kcs. worth of electricity each year. The government

(1) The bulk of Bulgaria's need is imported from the USSR at about 29-30 rubles per 1,000 m³ (1975 prices). JEC., ed., East Europe Economies post Helsinki (Washington, 1977) p.385

(2) "Distribution of 1976 Power Consumption Examined", Energetika (Sofia), No. 7, 1977, p.8
 (3) "Minister Dwells on Achievements in Power Generation", Energetika (Sofia), No.7, pp.5-7
 (4) "Distribution of 1976 Power Consumption Examined", Energetika (Sofia), No.7, 1977, p.8

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has undertaken to institute strict energy conservation measures in the face of widespread wastage, but with little apparent success.

42. Total coal production in 1976 was 115 million tons, up 3.2% over 1975. Hard coal production, nearly all of it in the Ostrava-Karvina region, reached 28.3 million tons. Brown coal and lignite production, mainly focusing on the Severocesky region, totalled 63.1 million tons or 2.7% over 1975. Expansion in coal and lignite production is expected to continue at about 2-3% in 1977-1978. The 1980 goal of 126.6 million tons of coal (98.6 million tons brown coal/lignite, 28 million tons hard coal) appears within reach. To exploit these reserves and the coal industry in general, 55 billion Kcs. (\$9.6 billion at official exchange rate) are to be invested in much-needed machinery, pumps and drills and other capital inputs for the coal industry in the period 1981-1990. Despite these targets, demand will outstrip domestic supply and imports of about 6 million tons of coal a year from Poland and the Soviet Union will be necessary(1).

43. To supplement coal reserves as a source of electric power production, Czechoslovak planners count on steadily increasing nuclear power generating capacity, based on the country's large reserves of high-grade uranium. This capacity is forecast at 3,350 megawatts by 1984, and 10,500 megawatts by 1990 - an enormous jump from the 150 megawatts of installed capacity in 1975. The first two 400 MW reactors, a Soviet system of light water pressure reactors, are now in "extensive construction preparation" with equipment "gradually arriving" at the site(2). Consequently, by 1980 coal-powered plants will still be generating four-fifths of Czechoslovak electricity production, and nuclear power only 3.8%. Much work will have to be done to increase this low figure to the ambitious 33% in 1980 by nuclear power production recently announced by the Atomic Commission chief(3).

44. Czechoslovakia's present expansion rate of electrical energy output does not seem to be keeping pace with growth in domestic demand. Electrical energy produced in the first six months of 1977 totalled 32.9 billion kWh representing a 5.4% increase over output in the corresponding period in 1976, which with an output of 62.6 million kWt was below Plan but early forecasts for 1978 call for only a 3% increase, somewhat below the 1976-1980 planned annual target growth of 5.9%. On the

(1) "CEMA Co-operation in Securing Fuel, Energy Discussed", Revue Obchodu/prumyslu/hospodarstvi, No.5, 1977, k pp.12-13

(2) "Atomic Commission Chief Views Nuclear Energy Plans", Tvorba, No.32, 10th August, 1977, p.10

(3) Ibid.

other hand, during the first part of 1977 in Slovakia alone, industrial demand for electricity increased 7%, and residential demand rose 9-12%.

45. Czechoslovakia will continue to depend on imported, primarily Soviet, oil and gas as energy sources. Announced total deliveries of Soviet oil via the Druzhba pipeline in the 1976-1980 period amount to 88 million tons, which reflects a slowdown by comparison with the 10% yearly increase in deliveries which were made in the 1971-1975 period. Although the price of Soviet oil delivered to Czechoslovakia in 1977 was one-third below that of prices on world markets, such deliveries are becoming increasingly costly. Additional oil will be available after 1979 via the Adria pipeline which will supply crude oil imports from OPEC countries.

46. In the future, Czechoslovakia will import more natural gas as an alternative energy source to oil. Plans are to import 8 billion cubic meters of gas from the USSR from mid-1977 to 1980(1). After 1980, direct gas imports from the USSR are expected to increase around 30% annually, in addition to an annual payback of 2.8 billion cubic meters from Czechoslovakia's participation in the Orenburg pipeline project. Moreover, Czechoslovakia will import, from Iran via the Soviet Union, 3.6 billion cubic meters of natural gas annually after 1980, worth in total \$2.5 billion.

47. Basically, Czechoslovakia's energy picture remains problematic: much of the power generating equipment is outdated and the Five-Year Plan investment policies for 1976 and 1977 did not give enough attention to equipment replacement; the domestic grid system has, of late, frequently broken down leading to several brownouts. The country will become increasingly dependent on imported energy, at least until nuclear power generating capacity is developed sufficiently to provide significant amounts of energy - by 1990 at the earliest.

C. EAST GERMANY

48. The energy sector is still one of the bottlenecks of the German economy. Since 1960, the yearly rate of increase in gross output has averaged 3.2%, which is about half the increase rate in industry as a whole (6.1%). Labour productivity has also been low, registering only 1.5% in 1971-1975 (industry as a whole: 5.3%)(2). The coal industry which accounts for about 70% of primary energy requirements is

(1) "Energieenpass in der Tschechoslowakei", Neue Zürcher Zeitung, 2nd November, 1977

(2) DIW Handbuch DDR-Wirtschaft, (Berlin, 1977), p.121

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exclusively based on 300 brown coal strip mines, employing 100,000 miners, and will be under its greatest stress so far during the next decade. Crude production since 1970 has fallen 5.3% to 246.7 million tons in 1975, with only a slight increase to 250-254 m.tons projected for 1980(1). The GDR imported 9.4m.tons of hard and coking coal in 1975, mainly from Poland. Exports of lignite were 2.3 m.tons.

49. Although there is increasing exhaustion of the current open-cast mines(2), the new mines now being developed there have insufficient modern plant and equipment. Moreover, the costs of lignite extraction are steadily increasing as more remote deposits are worked and more lignite continues to be used in the costly coal-based chemical sector; hence these costs have tended to cancel out any advantages of saving on importation of fuel. In order to try and stabilize coal production, the energy sector will receive one-third of total industrial investments of 132 million marks (\$60 m. at official exchange rate) for 1976-1980.

50. Electricity production in the GDR rose 25% in the 1971-1975 period to reach 89.1 billion kWh in 1976. Yet supply has failed to meet demand as industrial output increased 33%; in addition, there is insufficient spare capacity in the power stations and this has led to inevitable frequency variations and voltage drops at peak times. Nevertheless, it will not be possible to correct the imbalance between electricity production, installed power and industrial production by 1980, nor will any power be exported.

51. The current 1977-1980 Plan period provides for an additional 5,000 MW capacity. About 27% will be at the planned nuclear stations at Lubmin and Arneburg, which will supplement the GDR's only station (880 MW) at Greifswald. Considerable co-operation between the GDR and the USSR in the electricity field is underway and includes the 1,800 MW plants at Thierbach, and 11 million rubles worth of equipment for the high tension line to Hungary(3).

52. Most of the GDR's oil imports (17 million tons in 1975) comes from the USSR, with the remainder from Arab countries. Total imports of Soviet oil from 1976 to 1980 will reach 88 million tons. Most of this crude will be refined in the GDR at the Leuna and Schwedt chemical combines. The yearly

(1) AC/127-WP/530, p.3

(2) Hard-coal mining will cease production in December, 1977 as the seams are exhausted. Over 15,000 miners "have been found new jobs", SWB (Eastern Europe), 4th August, 1977

(3) Klaus Siebald, GDR Minister of Energy "Further Expansion of the GDR Energy Base in Co-operation with the USSR", Presse-Informationen (East Berlin), No. 103, 1st September, 1977, p.2

increase in oil consumption has recently fallen and the GDR has also called for a nationwide restriction of oil consumption. GDR natural gas deposits are slim, though production reached 8.3 billion m³ in 1976. Since 1973 the GDR has been supplementing domestic output with natural gas from the USSR. Imports in 1976 totalled 4 billion m³ with 6 billion m³ set for 1980 and a total of 9 billion m³ in 1981 when the Orenburg pipeline comes on stream. The gas is still used principally in the fertilizer industry, though the GDR's largest power station opened in April, 1977 at Bitterfeld, is fired by domestic natural gas and not by coal(1).

53. The overall outlook is not too favourable. Even if the proportion of primary energy furnished by lignite in the GDR falls, as planned from 74% to 57% between 1970 and 1980, it will still remain the main source of energy (82%) for electrical production. A yearly lignite output of between 250-260 million tons will be needed to meet energy requirements. The only real bright spot will centre on the 160 or so firms (with 40,000 workers) which manufacture strip mining and conveyor equipment(2).

D. HUNGARY

54. The continuing rise in the cost of imported raw materials and energy both from the Soviet Union and the West, plus a domestic energy demand growing by 3-4% a year, has led the government to expand domestic production of fuel and power and to emphasize natural gas. Despite this, Hungary will become increasingly reliant on imported energy. Imports from the Soviet Union covered nearly 35% of Hungary's requirements in 1976: 7.3 million tons of crude oil; 1.1 million tons of coal/coke; 1 billion m³ of natural gas and 4.4 billion kWt of electricity. According to 1977 Plans, energy consumption is to rise 4% this year; 47% of total needs will be met through imports (1980: planned 56%).

55. In the coal sector productivity levels(3) are rising satisfactorily; however, efforts are being made to stop the trend in decline of coal production(4) which has fallen from 26.5 million tons in 1960 to about 25.4 million tons in 1977 because of chronic labour shortages and exhaustion of coal deposits. Planners "foreseeably count on" the 1980 output to

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- (1) Three coal-burning steam generators will be shut down which will reduce air pollution. BBC, SWB (Eastern Europe) 21st April, 1977
- (2) Adequately described in "TAKRAF Products show Performance and Quality", Presse-Informationen, No. 166, September, 1977, pp.5-6
- (3) Coal production per worker in 1960 was 259.7 tons; 1975: 447 tons
- (4) Mainly brown coal

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be 24-24.5 million tons with long-range plans to 1990 mainly calling for stabilization of output at about 28-30 million tons which will represent 18-20% of Hungary's energy output (1976: 34%)(1). As coal (including nuclear coal) is a vital component in the long-range plant construction programme, preparations are under way to invest about 28 billion forints(2) in the 1977-1985 Plan periods to modernize twenty operating mines and establish a large power plant a Bicske fuelled by local brown coal deposits(3).

56. Great stress is put on natural gas output which in 1976 reached 6.2 billion m³, with Soviet imports adding over 1 billion m³. Of the domestic production, 15% is used for residential purposes, 20% for the chemical industry, 40% by industry and transportation and 25-26% for power plant use. Over 65% of all households were supplied with pipe or bottled gas. As a result of this somewhat unexpectedly high domestic gas output, rationing was no longer necessary and, contrary to the general trend in Eastern Europe, gas production from coal has virtually ended(4). Nevertheless, domestic output and the reserves capacity at the Szeged fields are limited. Production by 1980 is set at over 10 billion m³ and the USSR will supply almost 80% of Hungary's natural gas imports of 3,800 million m³. At the same time, the natural gas transportation pipeline network which totalled 6,000 kms including all town gas pipelines in early 1977, is planned to expand by 600 km within the 1977-1980 period as part of the long-term programme to convert all homes from industrial to natural gas.

57. In the electric power sector, output is expected to be 27.5 billion kwt in 1980 from 1977 output of 24 billion kwt, but total 1980 consumption is anticipated at 35 billion kwt. Imports from the USSR through the CEMA grid will be 7.5 billion kwt or about 22% of the total. Some contribution towards the electricity supply will come later from Hungary's first nuclear reactor (1,760 MW capacity) at Paks, constructed with Soviet help, which will come on stream in the early 1980s. An additional 5-6,000 MW will be available through new nuclear plants in 1990: nuclear power will represent 10% of total energy output.

(1) "Timely Tasks of Energy Management", ENERGIAGAZDALKODAS, No. 7, July, 1976, pp.291-294

(2) 1 forint = .025 (commercial rate) or \$70 million. Because of the unprecise nature of exact foreign exchange equivalents this dollar figure should only be considered a rough guide

(3) "Good Luck - with Good Efficiency", FIGYELŐ, 7th September, 1977 pp.1-2

(4) "Gas Supply Programme Examined", NEPSZAVA, 23rd September, 1977, p.3. The great hopes placed in national gas are reviewed in "The Role of Natural Gas in the Fifth Five-Year Plan", ENERGIAGAZDALKODAS, No.11-12, November-December, 1976, pp.478-481

58. Oil production totalled 2.1 million tons in 1976, up 4.7% over 1975. Output in 1977 will be about the same, with the remainder of Hungary's requirements (8 million tons) imported from the USSR. Hungary is currently building, with Yugoslavia and Czechoslovakia, the Adria oil pipeline to run from the Adriatic to Hungary. This pipeline, financed by the World Bank, Kuwait and Libya, will have a capacity of 10 million tons per year, of which half will join the existing domestic system. This project is putting a considerably strain on the Hungarian oil and gas equipment industries which are already committed to increasing considerably the domestic oil/gas pipeline and reservoir system, as well as on the labour supply: Hungary will have to import supplementary supplies from the West if construction progress is not to be delayed. Nevertheless, this new access to Middle East oil will give Hungary the degree of energy flexibility which it badly needed in the last Five-Year Plan.

E. POLAND

59. Poland is the world's fourth largest producer of hard coal(1) with reserves put at about 100 billion tons. This provides Poland with its chief source of primary energy (78.6% in 1976 likely to dip slightly to 75% in 1980), and 15% of its major export earnings. Between 1971 and 1975 yearly output of hard coal rose from 145 million tons to 171.6 million tons, equivalent to an average annual growth rate of 4.3%(2). Lignite production in the same period rose almost 20% from 34.5 to 40.5 million tons. This coal (35 million tons) goes almost exclusively to its coal-fired power stations. Production in the current Plan period, however, is expected to grow at the slower rate of about 3% a year, from 179.3 million tons in 1976 to 207 million tons in 1980. Lignite production is projected to reach 100 million tons in 1980.

60. In 1976, Poland exported 14.4 million tons of hard coal to COMECON (of which 10 million went to the Soviet Union and 3 million tons of brown coal to the GDR), and 22.5 million tons or 58% of the total coal exports to the OECD countries. Most of this was steam coal, with coking coal exports (about 10 million tons) going to non-socialist countries. Imports from the Soviet Union reached 1 million tons. Poland is pushing hard to increase coal exports and has recently agreed with Italy to plan the construction of a slurry coal pipeline from Katowicze to Trieste.

(1) After the United States, USSR and China

(2) AC/127-WP/532

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61. In the field of electric power, the 1976 output was 104 billion kWh, a rise of 10% over 1975. Installed capacity stood at 17,675 MW. Consumption in 1976 was 105.4 billion kWh, increasing at 7% per year, giving rise to some concern that demand will far outrun supply by 1980 and cause serious problems before new capacity is brought on stream. During the 1981-1985 Plan, Poland will construct, with Soviet help, its first nuclear power station (2 x 440 MW) at Zarnowiec (Gdansk), with a 4,000 MW unit to follow later in the decade.

62. Like most of her East European neighbours, Poland has very limited domestic oil production (0.55 million tons in 1976) which fell far short of 1976 requirements (15.7 million tons), the difference being imported from the USSR. By 1980, Soviet supplies will still remain at about the same level, forcing Poland to look elsewhere for additional oil to meet the projected consumption requirements of 20.5 million tons. The rising cost of oil imports*(1) has, therefore, given added urgency to plans to develop Poland's domestic oil reserves and obliged her to reduce planned oil imports. Despite exploration efforts in Poland and USSR-GDR joint exploration projects in the Baltic, it seems highly unlikely that any major discoveries will be made in the shorter term. Poland will, therefore, be forced to cut back on the planned expansion of her oil processing and petrochemical industries to accommodate crude oil imports of 20 million tons in 1980 compared with earlier plans of 28 million tons. Negotiations with Algeria and Iran are now under way and will probably result in the delivery of sufficient supplies at world price levels.

63. Natural gas production in 1976 totalled 5.7 billion m³, slightly down over 1975. Domestic production so far in the decade has been static as newly discovered fields proved disappointing and Poland has to rely on increasing imports from the Soviet Union. Consumption of natural gas is currently estimated at around 8 billion m³ planned to rise to 9.9 billion m³ in 1980 of which 5.3 billion m³ will come from the USSR, i.e. 54% of total Polish consumption(2). Poland is currently taking part in the construction of the Orenburg gas pipeline and will receive an additional 2.8 billion m³ in return for providing labour, welding equipment, pipes and insulating material.

(1) Oil (crude oil and petroleum products)

* Cost in 1975 was 3.4bn. zlotys for 16.4m. tons or 8.1% of total imports; 1970 figures were 790m. zl., 9.4m. tons; 3.4%
 1 See Z. Fallenbuchl et al, "East European Reactions International Commodity Inflation" in JEC., East European.
 op cit. p.68

(2) AC/127-WP/532, p.4

64. The development of Poland's energy resources will depend on its ability to overcome problems of waste, low productivity growth and financing. The Polish mining industry is currently undergoing a fairly severe labour shortage and productivity levels lower than those in the USSR or UK. More concerted efforts are now also being made to reduce unnecessary energy consumption in industry and communications (especially the State railroad system); plans call for an expenditure of 11 billion zlotys to bring about savings of almost 9 million tons of S.F.E.(1)

65. The provision of the necessary investment funds for the coal industry has also posed difficulties in the light of Poland's growing indebtedness to the West of an estimated \$12 billion (end of 1976). It has been estimated that the 15-year project for the development of the Lublin coal basin will cost some 50,000 million zlotys (\$15 billion) and West German firms will obtain orders worth up to DM. 2.6 billion for two coal gasification plants. For the period 1976-1980, about 71 billion zlotys have been allocated to the coal industry which illustrated the continuing importance of coal mining in the Polish Five-Year Plan (1971-1975: 43 billion zlotys); however, overall the share coal represents in total industrial investment has been falling (1961-1965: 15.3%, 1971-1975: 7.6%).

66. Polish energy trade is an important aspect of her overall trade imports and represent a major success in the Polish trade picture. Exports for fuels and electric power in 1975 increased 56% over 1974 to reach 6.8 billion zlotys, or 20% of total exports (1974: 5.4%). Of this, 8% (2.7 billion zlotys)(2) went to CMEA countries. The net energy trade in 1976 reached a record 3 billion zlotys, or \$1.5 billion.

F. ROMANIA

67. Romania's energy prospects are less than favourable, for it appears that the March, 1977 earthquake severely damaged about one-third of the Floesti oil complex. A significant slow-down in oil refining would necessitate expensive imports and would be a blow to the already strained Romanian economy. Even before this difficulty, the 1976-1980 Plan of a GNP annual growth rate of 8%, was untenable given the 1971-1975 annual increase output rate of 3.8% and consumption of 5.1% and the cutback of 10-15% of planned energy investment in 1978.

(1) "Energy Conservation for Rail Transport Urged", Sygnaly, 3rd August, 1977, pp.1-2

(2) At the commercial rate of: 1 zloty = \$0.05; 6.8 billion zlotys = \$3.4 billion; 2.7 billion zlotys = \$1.35 billion

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68. Romanian electricity production of 58.2 billion kWt in 1976 (8.4% above 1975) rising to 63.1 billion kWt in 1977 and forecast to reach 75-80 billion kWt in 1980(1), is sufficient to meet demand and to allow for some export (3.7 billion kWt in 1974 or 10% of total output), mainly to the border areas in Bulgaria. Almost all electricity is generated by coal or natural gas and there is virtually little short-term activity in the nuclear field; medium-term plans, contrary to those in Bulgaria and Hungary, do not call for a massive switch to nuclear power. Nevertheless, long-term plans (1985-1990) do provide for the construction of "several" nuclear power stations with a total capacity of 6,000 MW or 20% of total electricity production(2).

69. Romania plans a considerable boost in its coal production from 33.5 m.tons in 1977 to 5.4 million in 1978. The 1978 figure is below the target set in the original 1976-1980 Plan(3). Domestic production of coke is not keeping pace with the requirements of the iron and steel industry as about half of the coal/coke demand has to be imported. Indeed, the recent miners' disturbance at Jiu over consumer benefits is connected to the intense efforts of the government to boost faltering productivity rates at the expense of the miners' living conditions.

70. Romania's energy production programme for 1977-1980 is based more on gas than oil. Natural gas now represents slightly over 50% of its primary energy. The country is now the sixth largest producer in the world (27.8 billion m³ in 1977). Nevertheless, Romania is holding output at this level to husband rapidly diminishing reserves. More than 30% of gas is used for the production of electric and thermal power rather than its more profitable and effective use in chemical and petrochemical industries. Plans for 1980, however, call for development of lignite production to be used in newly constructed power stations near the country's major coal fields at Oltenia.

71. Romania's oil industry is now riding near its peak production at 14.8 million tons a year with production to increase 6% to about 15.5 million tons by 1980 (half the 1971-1975 growth rate), but even this modest target will require extensive use of secondary recovery methods to eke out additional oil from existing fields. At present Romania imports about 4-5 million tons a year from Iran and Libya in order to increase its refinery output for eventual export, but will

(1) SWB (Eastern Europe), 3rd March, 1977. Per capita consumption was 2,529 kWt in 1975. SWB (Eastern Europe), 11th October, 1976.

(2) SWB (Eastern Europe), 2nd June, 1977

(3) RFE Research, "Romania/36" 23rd December, 1977, p.14

need to step up these imports to 11 million tons of oil by 1980 if it wishes to meet ambitious industrial growth targets.

72. Exports of oil and oil products, which in 1975 were 5.75 million tons mainly to COMECON, and forecast to rise 75-80% by 1980. After accounting for oil imports of 5 million tons, net export trade in 1975 was 843,000 tons. In order to maintain oil production Romania is trying to expand its refinery capacity with the aid of Kuwaiti financing. Exploratory drilling along the Black Sea continental shelf is also now under way aided by a US-built offshore drilling platform. Nevertheless, unless substantial discoveries are made, Romanian production will fall in the 1980s and more and more expensive oil imports will be needed to supply the existing refineries and chemical complexes.

TABLE 1

STRUCTURE OF PRIMARY ENERGY CONSUMPTION %

		COAL	OIL	NATURAL GAS	PRIMARY POWER
BULGARIA	1960	89.2	8.1	-	2.7
	1965	77.4	20.6	0.5	1.5
	1970	57.2	40.2	1.9	0.7
	1975	45.8	47.3	4.0	2.9
	1980	39.5	41.5	13.6	5.4
CSSR	1960	89.5	6.4	3.5	0.6
	1965	85.4	11.8	1.8	1.0
	1970	74.9	20.0	4.0	1.1
	1975	65.8	26.7	6.4	1.1
	1980	62.0	27.1	9.1	1.8
GDR	1960	97.8	2.0	0.2	neg
	1965	95.4	4.4	0.1	0.1
	1970	89.6	9.2	1.1	0.1
	1975	79.3	11.6	8.8	0.3
	1980	71.9	17.5	9.6	1.0
HUNGARY	1960	78.0	18.2	3.4	0.4
	1965	69.0	23.8	6.5	0.7
	1970	54.0	30.0	14.5	1.5
	1975	39.4	39.6	19.6	1.4
	1980	31.1	40.8	26.1	2.0
POLAND	1960	96.9	1.5	1.4	0.2
	1965	93.1	4.3	2.5	0.1
	1970	82.2	11.0	6.5	0.3
	1975	78.1	14.5	7.2	0.2
	1980	78.3	18.4	8.8	0.5
ROMANIA	1960	22.8	29.5	47.5	0.2
	1965	22.0	24.2	53.6	0.2
	1970	25.8	24.2	49.9	0.1
	1975	25.9	24.8	48.2	1.1
	1980	34.6	26.5	37.9	1.0
USSR	1960	53.2	28.0	8.9	1.0
	1965	43.2	30.7	17.9	1.2
	1970	35.9	34.8	22.7	1.4
	1975	32.3	38.2	24.5	1.2
	1980	30	38-39	26.0	

Source: Annex II and III to AC/127-D/559

TABLE 2

RUSSIAN CRUDE OIL AND PRODUCTS EXPORTS BY COUNTRIES

	1976		1975		1976		1975	
	Metric tons (thousands)	Dollar value* (millions)	Metric tons (thousands)	Dollar value* (millions)	Metric tons (thousands)	Dollar value* (millions)	Metric tons (thousands)	Dollar value* (millions)
EUROPE								
Czechoslovakia	17,233	792.9	15,965	664.9				
East Germany	16,766	725.7	14,952	568.9				
Poland	44,073	798.5	13,271	655.3				
Italy	11,982	1,057.6	6,883	529.6				
Bulgaria	11,869	601.0	11,553	534.1				
Finland	9,620	861.8	8,768	732.4				
Hungary	8,435	509.4	7,535	416.8				
West Germany	7,132	778.7	7,634	641.6				
France	5,729	502.6	3,307	259.9				
Yugoslavia	4,858	430.0	4,444	267.9				
United Kingdom	4,051	376.6	1,503	131.3				
Sweden	2,729	225.5	3,450	233.3				
Netherlands	2,674	297.8	3,090	269.3				
Belgium	2,082	187.7	1,255	106.9				
Spain	2,002	172.5	1,724	135.4				
Greece	1,948	176.2	1,888	151.7				
Denmark	1,632	146.8	1,178	91.6				
Austria	1,513	133.8	1,327	105.1				
West Berlin	1,072	107.5	848	81.0				
Portugal	1,039	90.5	1,056	84.1				
Switzerland	942	91.1	960	83.2				
Iceland	417	43.5	448	44.5				
Norway	218	20.2	203	24.3				
Ireland	155	11.4	176	11.6				
Malta	0	0	34	1.8				
MIDDLE EAST								
Cyprus	257	17.8						
Syria	383	38.9			206	12.5	2	1.0
ASIA-PACIFIC								
Japan	1,773	152.6			1,320	91.3		
India	1,113	132.3			1,207	126.3		
North Korea	1,061	59.0			1,110	35.9		
Vietnam	439	19.5			403	19.2		
Mongolia	415	34.6			364	17.7		
Afghanistan	149	19.3			149	17.4		
Bangladesh	95	10.9			167	17.5		
Nepal	77	8.5			59	5.8		
AFRICA								
Morocco	665	67.7			649	51.6		
Ghana	250	21.8			144	12.7		
Egypt	226	29.4			231	25.6		
Somalia	136	11.9			118	11.6		
Guinea	81	9.9			62	6.3		
Liberia	24	1.8			27	1.8		
WESTERN HEMISPHERE								
Cuba	8,809	389.1			8,060	335.1		
Brazil	1,071	94.9			1,475	119.8		
United States	1,059	93.7			539	45.3		
Canada	93	8.1			220	15.7		
Other	166	14.0			397	79.5		
Totals	148,514	*10,383.0	180,351	*7,878.1				
Total East Europe	68,300	63,200						

Official Soviet exchange rate, July 1, 1977: \$1.35/ruble.

Note: U.S.S.R. 1976 oil imports: 1976—7,222,000 metric tons (6,425,000 tons of crude and 797,000 tons of products) valued at \$670,137.0; 1975—7,559,000 metric tons (6,459,000 tons of crude and 1,060,000 tons of products) valued at \$674,691.0.

Source: U.S.S.R. Ministry of Foreign Trade 1976 Statistical Summary.

Reference: The Oil and Gas Journal, 15th August, 1977.

TABLE 3

USSR GAS EXPORTS BY COUNTRIES

	1976		1975	
	Billion (cu m)	\$ value* (millions)	Billion (cu m)	\$ value* (millions)
Czechoslovakia	4.28	199.8	3.69	127.0
West Germany	3.97	122.0	3.09	74.6
Italy	3.72	70.3	2.34	51.7
East Germany	3.36	126.0	3.30	67.4
Austria	2.78	125.8	1.88	77.1
Poland	2.54	110.1	2.50	94.9
Bulgaria	2.22	100.4	1.18	47.0
Hungary	1.20	45.9	0.60	24.2
France	1.00	34.3	-	0
Finland	0.87	55.5	0.71	45.5
Total				
Total East Europe				

* Official Soviet exchange rate, July 1, 1977: \$1.35/ruble.

Note: U.S.S.R. 1976 gas imports and value were: Iran—327.6 billion cu ft valued at \$195.1 million and Afghanistan—83.25 trillion cu ft valued at \$42.5 million; 1975: Iran—337.4 billion cu ft valued at \$197.9 million and Afghanistan—100.7 billion cu ft valued at \$47.9 million.

Source: U.S.S.R. Ministry of Foreign Trade 1976 Statistical Summary.

* \$ 1.35/ruble as per 1st July, 1977

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TABLE 4

ACTUAL AND PLANNED USSR EXPORTS OF NATURAL GAS
TO WESTERN EUROPE (bn m³)

	1975	1976	1978	1980	1963
AUSTRIA	2.0	2.8	2.4	2.4	2.4
FINLAND	0.7	0.8	1.0	1.4	1.4
FRANCE	-	-	2.5	4.0	4.0
FRG	3.0	4.0	6.5	9.5	9.5
ITALY	2.3	3.7	6.0	6.0	8.0
TOTAL	8.0	11.3	18.4	22.3	23.2

TABLE 5

BREAKDOWN OF COMECON ENERGY PRODUCTION FIGURES
FOR 1976

	Oil (1975) (m. tons)	Gas (bn. m ³)	Hard coal (m. tons)	Lignite (m. tons)	Electricity (bn. Kwt.)
BULGARIA	.1	0.2 2	0.2 8	25.1	31.2
CZECHOSLOVAKIA	.1	0.9 3	28.2	89.4	62.6
GDR	.1	8.3	0.45	246.8	89.1
HUNGARY	2.01	6.8	2.9	22.3	20.4
POLAND	.5	6.69	179.3	39.3	104.0
Romania	14.6	27.8*	7.1	20.0	58.2
USSR	520	321.0	712.0		1,111.0

* 1977 figure

Source: National Handbooks

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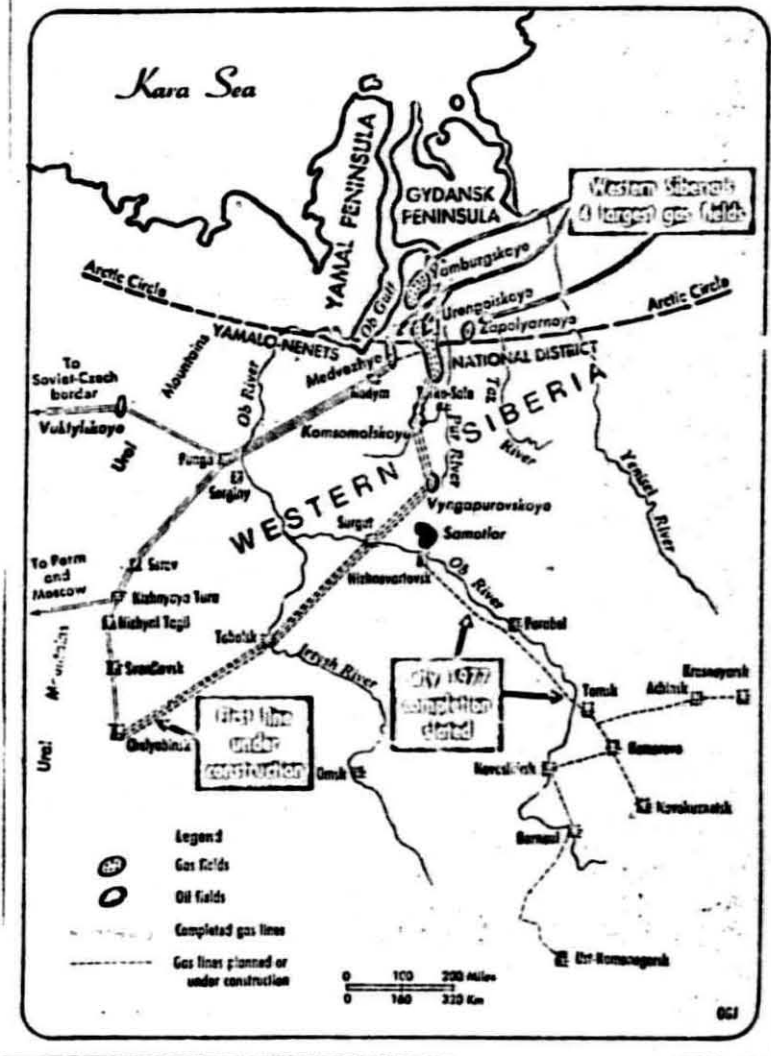
TABLE 6

USSR EXPORT OF ENERGY PRODUCTS

	<u>1975</u>	<u>1976</u>	<u>Per cent</u>
<u>Coal</u> (thousand tons)			
<u>Total</u>	26 143	26 896	100
<u>Western Europe:</u>	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
<u>CMEA countries:</u>	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	
<u>Coke</u> (thousand roubles)			
<u>Total</u>	207 485	207 015	100
Austria	4 902	4 393	
Finland	41 687	43 076	
Sweden	215	81	
<u>Total</u>	46 804	47 550	23.0
Bulgaria	11 943	12 171	
Hungary	33 338	34 765	
GDR	51 550	52 069	
Romania	44 368	45 283	
<u>Total</u>	141 199	144 228	69.7

1. GAS FIELDS (WEST SIBERIA)

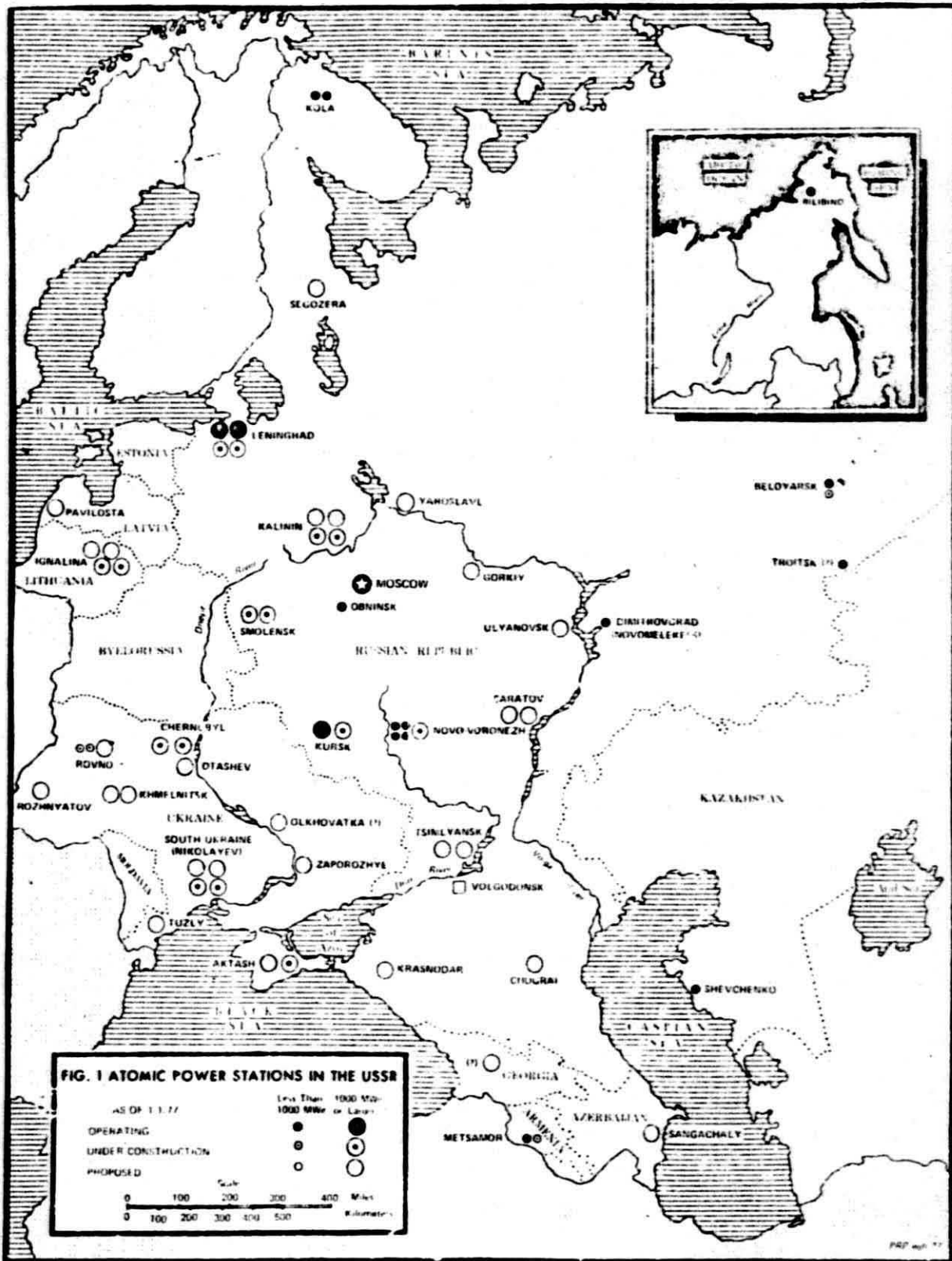
Where pipelines are tapping giant gas fields



Source: Oil and Gas Journal, 6th June, 1977 - p.68

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2. NUCLEAR POWER PLANT LOCATIONS



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

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(2) Coal

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(3) Electricity

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

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ANNEX III to
AC/127-WP/529

"Russia's Nuclear Power Plans", Financial Times, 11th May, 1977. The Soviet nuclear programme and its difficulties is well analyzed in the German Delegation ed., "The Soviet Nuclear Power Plan Programme", AC/127-WP/529 and Courrier des pays de l'Est No. 194 (1976). Nuclear energy integration efforts are outlined in Bethkenhagen, op.cit., p.53.

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