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Soviet Energy Prospects Into the 1990s

National Intelligence Estimate

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SOVIET ENERGY PROSPECTS INTO THE 1990s

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The following intelligence organizations participated in the preparation of the Estimate:

The Central Intelligence Agency, the Defense Intelligence Agency, the National Security Agency, and the intelligence organizations of the Departments of State, the Treasury, and Energy.

Also Participating:

The Assistant Chief of Staff for Intelligence, Department of the Army

The Director of Naval Intelligence, Department of the Navy

The Assistant Chief of Staff, Intelligence, Department of the Air Force

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FOREWORD

This Estimate is the US Intelligence Community's first integrated assessment of Soviet energy policies and prospects. It brings together the Community's best information and judgments on energy production possibilities, consumption trends, export needs both to supply Eastern Europe and to earn hard currency, investment costs, and policy priorities.

During the past several years, members of the Intelligence Community—in particular CIA and DIA—have published differing forecasts of Soviet energy production, consumption, and exports. The Estimate reflects considerable change over the past several years in some Community members' view of Soviet oil production prospects. In particular CIA, which in 1977 and 1978 predicted rapid declines in Soviet oil production beginning around 1980, has substantially changed its assessment. The current CIA view is that Soviet oil production will level off in the mid-1980s and then begin a relatively slow decline. There appear to be two principal reasons for the substantial change in the CIA estimate:

(1) Information from intelligence sources that became available in recent years indicates that Soviet proved oil reserves are probably about twice as large as CIA previously thought.

(2) The Soviet leadership became very concerned about oil production and, beginning in 1977, set in motion an intensive, high-priority effort to develop West Siberian oil and gas as quickly as possible, with the help of rapidly rising investment expenditures.

In addition to new information on energy production possibilities and Soviet energy policies, the Estimate reflects the findings of recent studies of Soviet energy demand, including the possibilities for consumption, substitution, and conservation.

Although differences remain among experts and between agencies, there is a broad consensus on the general trends and problems of the Soviet energy sector and the principal energy trade-offs facing the Soviet leadership. There is also a broad consensus on the nature and importance of the USSR's dependence on the West for energy markets, equipment, and technology.

KEY JUDGMENTS

Soviet energy developments are likely to affect US and Western interests in two principal ways. First, with the largest energy reserves in the world, the USSR in the long term has the potential to become a major source of energy, especially natural gas, for the West. This would mean a large boost to Moscow's hard currency earnings and a basis for expanded Soviet influence in Western Europe. Second, in the 1980s the rising cost of energy development is diverting investment resources that are badly needed elsewhere in the Soviet economy. This is making the choices among consumption, investment, and defense substantially more difficult. Soviet efforts to minimize these difficulties could result in energy production levels too low to even maintain the present level of total energy exports over the remainder of the decade while meeting domestic energy requirements.

The USSR is in transition from reliance on cheap energy to the use of expensive energy. Unlike the West, which has already completed much of its adjustment, however, the USSR will feel the major impact of this transition in the 1980s. Because of the inertia of Soviet planning and the overwhelming emphasis given to meeting production targets, the USSR has not yet made any significant progress in holding down the demand for energy through conservation. Energy consumption has grown faster than GNP, and is likely to grow at a rate close to that of GNP in the 1980s unless Moscow is willing to push energy conservation even at the expense of other economic objectives.

Consequently, Moscow must increase investment in energy production very rapidly if it is to meet domestic energy requirements and avoid a decline in hard currency earnings. In 1981-85, energy investments are increasing by about 60 percent over those of 1976-80, mainly because of a near doubling in oil investment and a two-thirds increase in investment in gas development and pipelines; in spite of rapidly rising investment, the rate of growth of energy output is declining. Energy is now taking over 20 percent of total investment, up sharply from about 15 percent in 1976-80. The resulting large claim on investment resources at a time when the growth of total investment has slowed is making it difficult for other sectors to get their new programs funded and has become a major factor depressing the growth of the Soviet economy. Investment in heavy industry is increasing slowly; efforts are

being made to rebuild the transportation sector after decades of neglect; agriculture is holding its own in investment allocations, and together with energy is taking 40 percent of the total; investment in consumer-oriented sectors—housing, light industry, and services—is probably falling in absolute terms.

The investment burden will probably continue to mount during the second half of the decade unless the growth of energy consumption, especially of oil, can be slowed, thereby permitting domestic and export needs to be met with a slower growth of energy production. A continuing squeeze on investment in other economic sectors might jeopardize objectives for raising living standards or possibly even military production. Consequently, energy policy is likely to be a contentious issue in preparing the next five-year plan; specifically, political opposition to costly production-oriented energy policies is likely to build.

A Soviet policy shift involving increased reliance on energy conservation and interfuel substitution to assure adequate energy supplies, while reducing the investment burden, would involve risks of misjudging the volume of energy savings that the Soviet economic system could generate. In such an event, energy supplies would become insufficient to cover demand, resulting in worsening domestic energy shortages and a sharp decline in energy exports until policies were corrected.

We do not yet have any clear indications of Soviet policy concerning energy investment, production, and consumption during 1986-90. Some critical policy decisions probably have not yet been made. In this uncertain situation, judgments differ about which energy policy mix is likely to be adopted, and on how much difficulty the USSR is likely to experience in achieving an acceptable balance among its main energy objectives. Some analysts, including those in DIA, believe that Moscow will correctly assess both demand trends and the technical requirements for energy production, and consequently will produce as much oil as is necessary to meet domestic and export needs. They believe that if progress in energy conservation and interfuel substitution proves to be slow and Moscow considers it necessary to maintain oil exports, the Soviets would keep oil production fairly constant. They realize that the burden of energy investment may continue to increase, but believe that the increase will not be large. Moreover, Moscow may believe that the economic benefits from incremental energy investments—especially the resulting hard currency sales—are such, on balance, as to enhance the overall productivity of

the economy. Other analysts, including those in CIA/DDI, believe that rapidly rising investment costs and worsening operating conditions are likely to lead to a gradual fall in oil production after 1985. They also believe that the Soviet leadership will, as in the past, overestimate the possibilities for energy conservation and interfuel substitution. Consequently, shortfalls in oil supply could develop that would disrupt the domestic economy and squeeze exports. Because opportunities to reduce oil deliveries to Eastern Europe and to increase gas sales are limited in the 1980s, these analysts project a decline in hard currency earnings from energy exports if oil and gas prices are unchanged.

The cost of producing Soviet oil, historically low by world standards, is rising rapidly and is likely to continue to increase. Productivity of new wells in West Siberia is declining as exploitation shifts from the highly productive giant and supergiant fields, which have peaked or soon will peak, to smaller, less productive fields. Secondary and enhanced recovery methods are increasingly being applied to mature fields, especially in the older producing regions, in order to slow the declines in production rates.

The Soviets plan only a small increase in oil output through 1985 and, because of an intensive investment effort in West Siberia, they will probably reach the plan goal of 12.6 million barrels per day or come close to doing so. Oil reserves are sufficient to sustain production at this rate for the remainder of the decade. However, with the cost of oil extraction likely to continue increasing rapidly, with gas-for-oil substitution, especially in industry and electric power, offsetting rising oil demand in transportation and agriculture and possibly permitting oil consumption to level off in the latter part of the decade, and with gas exports rising rapidly, Moscow may accept a decline in oil production in the latter part of the decade.

Natural gas is, in the long term, the USSR's cheapest energy source. On completion of the current massive program to build five long-distance pipelines from the remote West Siberian gasfields to supply the consuming regions in the USSR and one to supply Eastern and Western Europe, the Soviets will be able to further expand gas production at moderate and fairly constant cost. By the late 1980s, gas production will probably approach that of oil (in terms of caloric value), unless limited by domestic and foreign demand.

Coal production is unlikely to increase appreciably until the USSR can develop or acquire technologies that would make the transportation of coal from areas east of the Urals or the long-distance transmission of

electric power economically justified. Such technologies are unlikely to be available until the 1990s. Although the Soviet nuclear power program continues to lag far behind plan, about half of the likely increase in electric power production in the 1980s will come from nuclear plants.

Energy exports in the balance of the 1980s will be affected by a complex mix of factors that neither we nor the Soviet Government can predict with any confidence, including energy prices in the West. Moscow's main concern with respect to energy exports will be to earn the hard currency necessary to buy needed imports from the West while continuing to supply at least the minimum needs of its client states. Gas exports probably will rise by two-thirds while total oil exports will probably decline.

Eastern Europe may not be able to rely on supplies of Soviet oil to the extent it has in the past. The tight hard currency position of the European countries prevents them from turning to the world market for large added supplies of oil. There is a potential in Eastern Europe for energy conservation and for some further substitution of Soviet gas for oil in industry, but progress will be slow. A further cut in Soviet oil deliveries to the near-stagnant economies of Eastern Europe would intensify the need for austerity measures and aggravate the danger of popular unrest there. Because it holds the trump card of coercive power, however, Moscow is likely to impose further cuts on the supply of oil to Eastern Europe if oil supplies would otherwise be inadequate to meet priority objectives of the regime.

Moscow will continue to stress energy exports for hard currency to buy technology needed for industrial modernization and for special applications in energy exploitation and defense production, and to acquire the agricultural products necessary to offset domestic shortfalls. Although oil exports will probably decline, the USSR will place a high priority on maintaining these exports at a substantial level because of their importance and flexibility as a hard currency earner. Moscow will be in a position to offer the West European countries all the gas they are willing to buy in the 1990s and can undercut the prices of any Western supplier while still earning a large profit. If and when the Siberia–to–Western Europe gas pipeline is used to capacity, Soviet gas exports to the West will double their present level. If Moscow lands contracts to supply even half of the West European gas-demand gap now foreseen for the 1990s, an additional pipeline the size of the one now under construction would be required, and dependence on Soviet gas could approach 50 percent of gas consumption for major West European

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countries, far in excess of the 30-percent share that we and some West European governments regard as a critical threshold for political risk.

Additional large Western purchases of Soviet gas would give the Soviets large economic gains. Increased Soviet gas production for export could substitute for exported oil at perhaps one-third of the investment cost. Alternatively, if oil exports were held constant, it would add greatly to Soviet hard currency earnings. Each new gas pipeline of the size of the line to Western Europe now under construction potentially permits additional gas sales worth nearly $5 billion annually at present prices, or about one-fifth of total current Soviet hard currency earnings. Such added hard currency earnings would enable Moscow to raise substantially imports of Western goods and technology that the Soviet economy badly needs.

The cost and speed of Soviet energy development will depend partly on the level of imports of Western energy equipment and technology. Although Soviet dependence on imports of Western pipe and compressors for gas pipelines should decline, dependence on imports of Western oil equipment will increase as production shifts to deeper and more complex onshore and offshore deposits. [1] Most of the needed equipment is available from non-US Western sources.

The high cost of Soviet energy development has possible implications not only for Soviet economic growth but also for military programs. Although the military will probably retain its premier position in the resource competition, it cannot be fully insulated from the consequences of economic problems. Even if there is little direct competition for resources between energy and military industries, the growing cost of assuring adequate energy supplies could indirectly be a factor slowing military expansion if it slows the development of the heavy industrial base on which future military growth depends.

[1] Detailed information on the Soviet oil and gas equipment industries and dependence on imports of Western oil and gas equipment is presented in the following publications:

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2. Congress of the United States, Office of Technology Assessment, *Technology and Soviet Energy Availability*, 1981.

3. SNIE 3-11/2-82, *The Soviet Gas Pipeline In Perspective* Sep 1982.

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DISCUSSION

Background

Soviet Energy in Perspective

1. Soviet energy resources are major assets. The USSR is the world's largest oil producer and has the largest oil reserves outside the Persian Gulf. Soviet gas reserves are the largest in the world, and this year or next the USSR should surpass the United States as the world's top gas producer. Coal resources are large, although unfavorably located. Oil and gas exports provide more than one-half of total Soviet hard currency earnings and supply the bulk of Eastern Europe's requirements for these sources of energy. Moscow has found oil exports, and more recently gas exports, to the West useful in pursuing its foreign policy objectives, and its exports to Eastern Europe are among the most important economic links solidifying the Soviet Bloc.

2. Although the USSR is better endowed with energy than any other country (table 1), it is, like the rest of the world, in a difficult transition from reliance on

Table 1
Countries With the Largest Energy Reserves, Yearend 1982 [a]

	Total *(billion barrels oil equivalent)*	Crude Oil *(billion barrels)*	Natural Gas *(trillion cubic feet)*	Coal *(billion metric tons coal equivalent)* [b]
World	4,707	667	2,985	687
USSR	1,107 (23.5) [c]	50 to 70 (9.0) [d]	1,201 (40.2)	165 (24.0)
United States	1,043 (22.2)	30 (4.5)	204 (6.8)	191 (27.8)
China	530 (11.3)	19 (2.8)	30 (1.0)	99 (14.4)
United Kingdom	249 (5.3)	14 (2.1)	25 (0.8)	45 (6.6)
Australia	189 (4.0)	2 (0.3)	18 (0.6)	36 (5.2)
Saudi Arabia	187 (4.0)	165 (24.6)	121 (4.1)	0
West Germany	175 (3.7)	NEGL	6 (0.2)	34 (4.9)
Poland	159 (3.4)	NEGL	5 (0.2)	31 (4.5)
Iran	144 (3.1)	55 (8.2)	483 (16.2)	NEGL
South Africa	128 (2.7)	NEGL	NEGL	25 (3.6)

[a] The portion of total resources exploitable under local economic conditions and available technology.
[b] Yearend 1980. Coal equivalent defined as 7,000 kilocalories per kilogram.
[c] Figures in parentheses show percentage of world total.
[d] Midpoint of range is used for calculation.

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cheap to relatively costly energy. Energy costs are rising as production moves into more remote areas and as production conditions become more difficult with the depletion of the highest quality oil and coal deposits.

Soviet Energy Policy

3. Soviet energy policy has evolved in the same direction as that of the major Western nations but with a lag and with differences which reflect the particular Soviet energy endowment and economic system. Through the 1960s and early 1970s, Moscow relied on increases in production of crude oil and natural gas to cover most of the growth of its energy requirements.

4. Between 1960 and 1973 Soviet crude oil production almost tripled. Soviet oil production strategy was to bring the largest and best fields to high production as quickly as possible, thereby ensuring maximum growth of output in relation to investment expenditures. Soviet drilling technology relied heavily on the turbodrill, which permitted the use of low-quality drill pipe and was well suited to the principal oil-bearing structures then being exploited. Early waterflooding raised reservoir pressures and, consequently, well productivity. This production strategy worked well in the 1960s as the Soviets exploited the rich deposits of the Volga-Urals area, including the supergiant Romashkino field. As production at these fields began to level off, even richer deposits were proved out in the West Siberian Basin, including the supergiant Samotlor field, so that continued substantial increases in oil production could be obtained at relatively little cost.

5. While continuing to develop the best West Siberian oilfields rapidly, the Soviets began to consider longer term energy strategies that took into account other energy sources and technologies. These included: expanded use of secondary and tertiary recovery methods in older producing areas; accelerated development of gas production, especially for export to the West; development of Siberian coal deposits; expansion of nuclear power; and progress in energy conservation. But many programs were initiated without any comprehensive assessment of technical requirements, costs, and priorities.

6. The need to reassess energy policy became increasingly apparent to the Soviet leadership in the mid-1970s. New supergiant oilfields were not being found, the growth of oil production was slowing and falling behind plan, and a leveling off, if not a decline, in production was in prospect within a very few years if something was not done. In addition, coal production and nuclear power plant construction were lagging behind plan.

7. A top-level decision on energy policy was made in late 1977 to give development of West Siberian oil and gas an even greater priority. In the case of oil, this decision led to a rapid increase in investment, including drilling, pumping, and infrastructure in order to maintain growth in output. The necessary skilled labor was obtained by rotating drilling teams from the older oil-producing regions, as well as by expanding the permanent West Siberian labor force. Although oil costs rose rapidly, oil production continued to increase, but at a slower rate. In the case of gas, an expanded program for building long-distance gas pipelines was undertaken. Infrastructure was expanded slowly into the major West Siberian gasfields.

Recent Soviet Energy Performance

8. In recent years the USSR has experienced a slowdown in the growth of energy production, consumption, and net exports (table 2).

- The growth of oil production has slowed to 1.7 percent a year in 1979-82 and to less than 1 percent in the past two years.
- Gas production increased at an average rate of 7.7 percent in 1979-82 and 7.3 percent in 1981-82, and has accounted for about two-thirds of the total increment to total energy production since 1978.
- Coal production has stagnated.
- Nuclear power production has increased fairly rapidly, although less than planned.
- The growth of total primary energy production has declined from about 5 percent per year in the early and mid-1970s to 2.9 percent a year since 1978.
- The growth of energy consumption has declined from 4.4 percent to 2.7 percent per year over the corresponding period, with natural gas increasingly used, especially in industry.

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Table 2
USSR: Trends in Energy Production, Consumption, and Trade

Million b/d oil equivalent

	1960	1970	1975	1978	1980	1982
Production	10.4	18.3	23.2	26.6	28.2	29.7
Oil [a]	2.9	7.1	9.8	11.4	12.0	12.3
Natural gas	0.8	3.3	4.8	6.2	7.2	8.3
Coal	5.2	6.1	6.6	6.8	6.7	6.7
Hydro	0.3	0.6	0.6	0.8	0.8	0.8
Nuclear	NEGL	NEGL	0.1	0.2	0.3	0.4
Other [b]	1.2	1.2	1.3	1.2	1.2	1.2
Consumption [c]	9.7	16.2	20.3	22.8	23.8	25.3
Oil	2.3	5.3	7.3	8.3	8.8	9.1
Natural gas	0.8	3.3	4.7	5.7	6.3	7.3
Coal	5.1	5.8	6.3	6.6	6.5	6.6
Primary electricity	0.3	0.6	0.7	1.0	1.0	1.1
Other [b]	1.2	1.2	1.3	1.2	1.2	1.2
Net exports	0.7	2.1	2.9	3.8	4.4	4.4
Oil	0.6	1.8	2.5	3.1	3.2	3.2
To West [d]	0.3	0.8	0.9	1.3	1.2	1.4
To Communist countries [e]	0.3	1.0	1.6	1.8	2.0	1.8
Natural gas	NEGL	NEGL	0.1	0.5	0.9	1.0
To West [d]	0	−0.1	−0.1	0.2	0.4	0.4
To Communist countries [e]	NEGL	0.1	0.2	0.3	0.5	0.6
Coal	0.1	0.3	0.3	0.2	0.2	0.1
To West [d]	NEGL	0.1	0.1	0.1	0.1	NEGL
To Communist countries [e]	0.1	0.2	0.2	0.1	0.1	0.1
Electricity	NEGL	NEGL	NEGL	NEGL	0.1	0.1
To West [d]	NEGL	NEGL	NEGL	NEGL	NEGL	NEGL
To Communist countries [e]	NEGL	NEGL	NEGL	NEGL	0.1	0.1

[a] Including gas condensate.
[b] Including peat, oil shale, fuelwood, and other renewable energy sources.
[c] Apparent consumption, that is, production plus imports minus exports.
[d] OECD countries plus non-Communist LDCs.
[e] CEMA countries plus Communist LDCs.

NEGL—may include amounts up to 50,000 b/d oil equivalent.

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— Total oil exports were up slightly from 1978 to 1982. During 1979-81, exports to Eastern Europe and Cuba increased while those to the West fell—although, thanks to higher prices, export earnings grew. In contrast, 1982-83 exports to Eastern Europe declined while those to the West increased.

Key Factors in Future Energy Development

9. Looking ahead to the remainder of the 1980s and beyond, the USSR faces a situation in which energy production can be increased fast enough to meet domestic and export needs only with rapidly rising investment and an intensive management effort. The

development of West Siberian oil and gas will be given a high priority; it will require enormous investments in production facilities, long-distance pipelines, and supporting infrastructure under difficult, near-arctic conditions. The Soviets in the 1981-85 Plan period are building the equivalent of 35 large-diameter pipelines of the length of the Alaskan oil pipeline, and are planning to drill about 75 million meters for oil development in West Siberia. They are building 14 nuclear power plants and expanding five others, and are planning to greatly increase secondary processing facilities at their oil refineries. The dimensions of these energy development programs are enormous on a world scale.

Production Possibilities

Oil

10. The USSR probably has sufficient oil reserves (50-70 billion barrels), to achieve oil production of 12.5 million b/d through the 1980s (the current rate is about 12.4 million b/d), but doing so would be difficult and expensive. Soviet oil production in the 1980s will depend mainly on the development of the West Siberian fields (figure 1). Most established oil-producing areas outside West Siberia are well into the declining phase of their development. With 60 percent or more of recoverable original reserves having already been produced in most large fields in the European USSR and in Central Asia, well productivities have fallen to low levels and the percentage of water in well flow has become very high. Oil production outside West Siberia has been falling by about 300,000 b/d annually since 1979, and continued declines are inevitable. Secondary recovery efforts can slow the decline in a few fields, but will not greatly affect the overall regional patterns. Because of the long leadtime required and high costs involved, exploration and development of potential oil-producing regions outside West Siberia (East Siberia, Sakhalin, Barents Sea) will not have a major impact on national production until the 1990s.

11. Production in West Siberia will continue to increase, but at a declining rate and at increasing cost. As shown in figure 2, the flow of oil per new well has been declining rapidly and the Soviets expect a continuing decline through 1985. Samotlor, the supergiant field which at peak in 1980 accounted for more than 25 percent of national production, is on the decline and most other large West Siberian fields have peaked. There is still considerable room for expansion of production in some very large fields (Fedorovo and Mamontovo, for example), but even these fields will probably peak by the mid-1980s. Geological analysis indicates that the Soviets may prove out large additional oil reserves in West Siberia, including gas condensate, but that the odds on finding new supergiant or very large giant fields are low. Consequently, an increasing share of West Siberian production is likely to come from small and medium-sized fields with well productivities far below those of the giant and supergiant fields in the earlier phases of their development, although still above those in the older producing regions of the USSR.

12. The Soviets are counting on continued substantial increases in West Siberian oil output, at least in the next few years. Development drilling is increasing rapidly and a new long-distance oil pipeline which will raise West Siberian pipeline capacity by about 1.8 million b/d is under construction. In the longer term, continued growth of West Siberian production will depend in large part on the quality of newly developed fields.

13. Development of West Siberian oil has involved major technical and management difficulties. These include the problems of producing oil under swampy, near-arctic conditions, shortages of skilled labor, high labor turnover, and the inherent difficulties of phasing and coordinating all of the necessary facilities. Although many facilities are already in place, the building of infrastructure will be a large, continuing burden.

14. In addition to the massive West Siberian development effort, the Soviets probably will have to maintain a roughly constant rate of drilling to support declining production outside West Siberia, and to accelerate exploratory drilling, which has fallen substantially as a share of total drilling, as attention shifts to more remote and geologically difficult producing areas. They will also have to deal with a high and increasing rate of depletion of existing capacity—currently about 95 percent of the annual new capacity merely offsets depletion.

15. Moscow will probably nearly double oil investment in 1981-85 compared with that of 1976-80.

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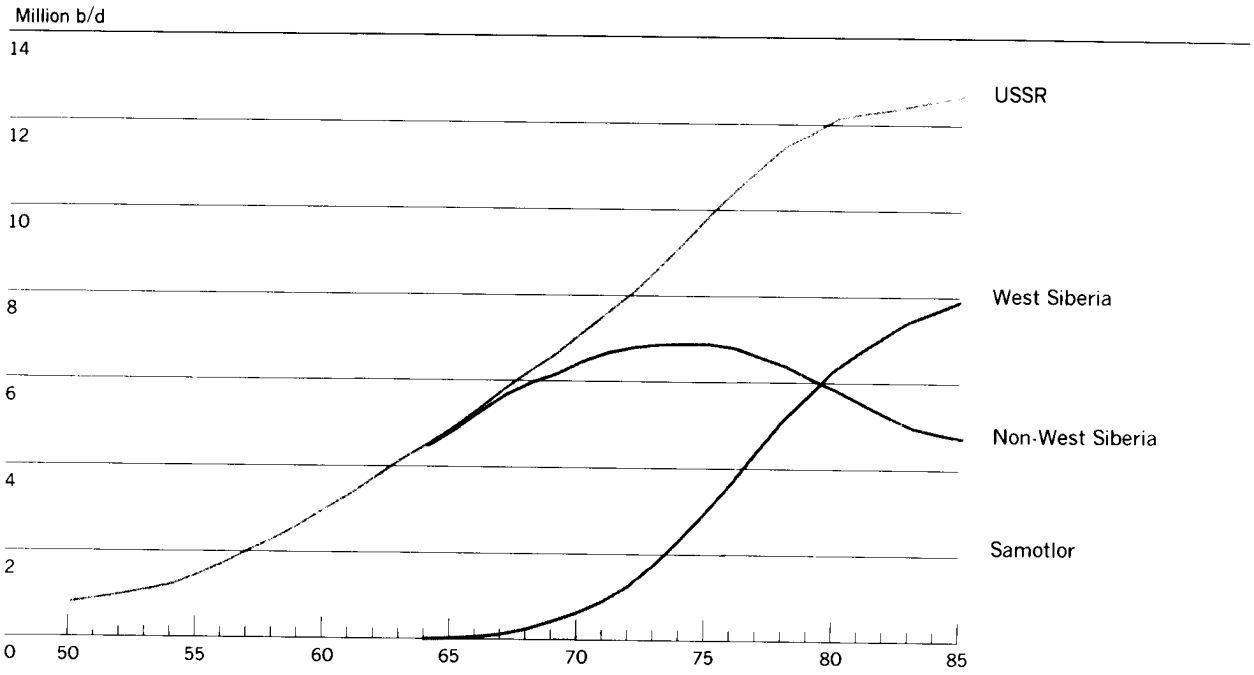
Figure 1
USSR: Oil Production



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Soviet statements, as well as our own analysis, indicate that oil investment will continue to increase rapidly in 1986-90. For example, Soviet specialists have calculated that development drilling would have to double every five years to maintain oil output at present levels.

16. The Soviets apparently are making the massive effort required to achieve the 12.6 million b/d production rate planned for 1985, and probably will fulfill the plan, or come close to doing so. Production projections for 1990 are far more uncertain. Whether or not production remains stable depends *inter alia* on the quality of new oilfields, the willingness of Moscow to incur increasing costs, how Soviet domestic oil consumption evolves, and how badly Moscow needs to maintain oil exports.

Natural Gas

17. With proved reserves of 34 trillion cubic meters, 40 percent of the world's total, the USSR has enough gas to sustain continued expansion of production for several decades. Although most of these reserves are of extraordinarily high quality—with potential well flow rates among the highest in the world—their location in the northern part of the West Siberian Basin, a region which is remote and also subject to permafrost and other arctic conditions, creates major difficulties for production and transportation. In addition to developing the enormous gas reserves in Tyumen, the Soviets are beginning to exploit sour gas deposits in the southern USSR—Astrakhan and Tenghiz—with the help of Western technology. This development will offset some of the decline in output of older fields, but will contribute less than 2 percent of national output in 1990.

18. In recent years a major constraint on the growth of gas production has been the construction of long-distance gas pipelines and gas processing plants. During the current Five-Year Plan the Soviets are building

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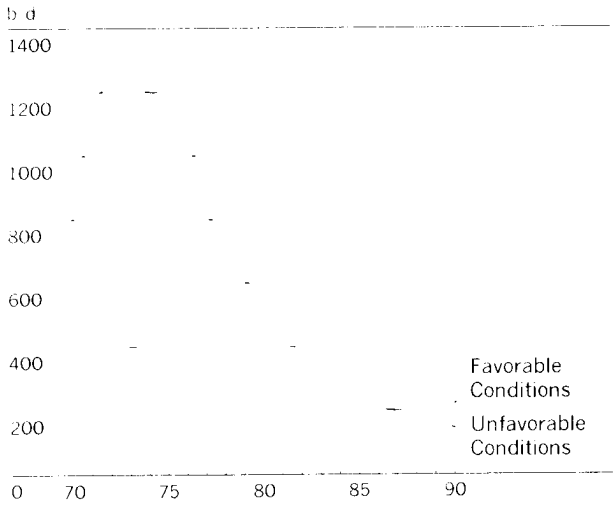
Figure 2
West Siberia: Average New Well Flows



six major trunk lines originating in the West Siberian gasfields, five of which are to be linked to the domestic gas network and the sixth is for export of gas to Western Europe (figure 3). Construction of these pipelines is a massive undertaking: together the six lines are 20,000 kilometers long; go through difficult terrain; require enormous amounts of large-diameter pipe, most of which must be imported from Western Europe and Japan, as well as large numbers of domestic and imported turbine-compressors, pipelayers, and other equipment; and, the requirement for skilled labor willing to work under arduous conditions is difficult to meet. Although the plan for laying pipe is on schedule, and annual gas production plans have been overfulfilled in the last two years, the plan for 1985, which requires substantially larger annual increments for production than in 1981-82, is not likely to be achieved, mainly because of lags in installing pipeline compressors and gas processing equipment. The chances are that gas production will be up to 5 percent below the planned 630 billion cubic meters but will still meet demand.

19. In the late 1980s, long-distance gas pipeline construction will continue to require a major effort. However, the main constraint on Soviet gas production will become the demand for gas, not the ability to build long-distance pipelines. To permit large increases in domestic gas consumption, the Soviets will have to make a major effort to expand the smaller lateral pipelines and distribution networks. Current plans call for construction of 28,000 kilometers of smaller lines by 1985; another large program will be needed during 1986-90. The ability to build these smaller pipelines and to substitute gas for oil and possibly for coal domestically and in Eastern Europe, and to market additional amounts of gas in Western Europe, will determine how much gas the Soviets produce.

Coal

20. As in the case of oil and gas, coal production is declining in the western USSR and increasing in the eastern USSR. Unlike oil and gas, however, much of the eastern coal cannot be exploited because of coal quality and critical transportation problems. Because of severe technical and economic problems, even to maintain coal output will require that the coal industry receive a higher priority in investment allocations than in the past. The coal industry's share in total investment in fuels and electric power has fallen from about 20 percent in the mid-1960s to 12 percent in the 1981-85 Plan, reflecting the increased requirements and priority of oil and gas. Even if investments in the coal industry increase substantially over the next decade, much of the increase will be required just to cope with the declining energy content of coal production.

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21. In the older coal regions, especially the Donets and Kuznetsk Basins, which still account for about 50 percent of coal output, physical conditions for production are rapidly worsening. Mine depth is increasing; seam thickness is decreasing; and methane concentrations are rising. Moreover, while labor productivity is declining, the Soviet Government is having great difficulty recruiting additional miners.

22. The USSR has several large coal deposits in Siberia and Kazakhstan, most of which can be mined by labor-saving open-cast methods, but the difficulties of transporting this coal to the principal consuming areas are immense. Production increases in the most accessible eastern coal basin, Ekibastuz, are adding a major strain to a rail system which is already in bad

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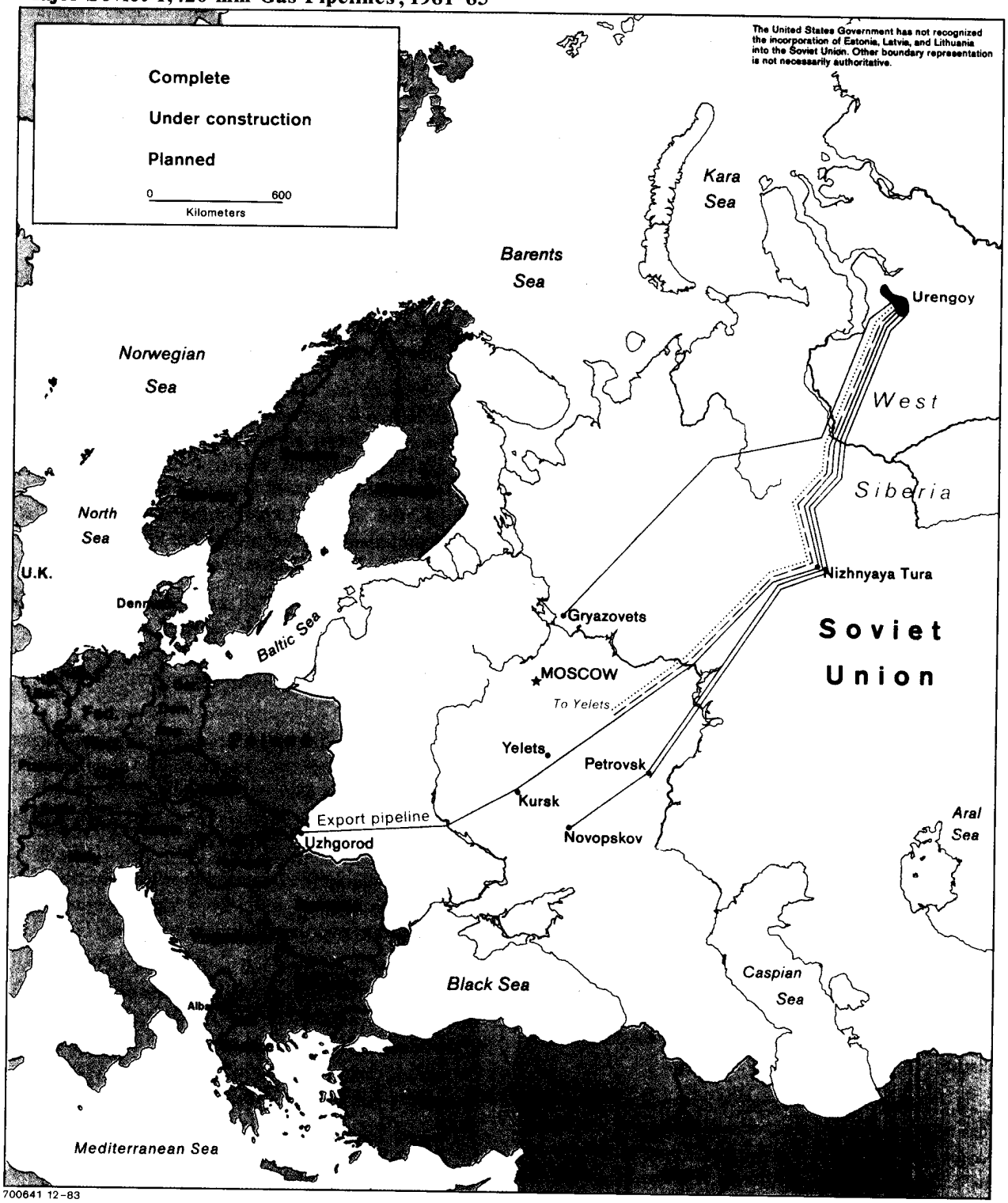
Figure 3
Major Soviet 1,420 mm Gas Pipelines, 1981-85



shape. The coal from the Kansk-Achinsk Basin in East Siberia cannot be transported for long distances in raw form because it contains more than 30 percent water and is subject to spontaneous combustion when exposed to air.

23. The Soviets have been exploring alternative technologies for using eastern coal domestically on a large scale in several general approaches, none of which could have a substantial impact during the 1980s:

— Burning the coal in power plants near the mines in Ekibastuz and Kansk Achinsk and transmitting the electricity to the western USSR over ultra-high-voltage power lines.

— Upgrading the coal quality through processing in facilities near the mines and transporting the resulting coal and synthetic fuel to the western USSR via railroads initially, and eventually in pipelines for coal slurry and synfuels.

— Working with Western firms, especially West German and Italian, or otherwise incorporating Western technology in the development of coal slurry pipelines, synthetic fuels from coal, and long-distance, ultra-high-voltage electricity transmission systems.

Electric Power

24. During the 1980s, nearly two-thirds of the likely increase in output of electricity will come from nuclear and hydro stations, predominantly nuclear stations. Construction and engineering problems held back the nuclear program in the 1970s, delaying completion of about half the planned projects, and construction of nuclear plants continues to lag behind plan. Even with these setbacks, nuclear generating capacity should grow from 12,500 megawatts in 1980 to at least 48,000 megawatts by 1990. Still, the below-plan growth in nuclear power (by perhaps 30,000 megawatts) will prevent the Soviets from meeting objectives to sharply reduce their reliance on fossil-fueled electricity generation.

25. At fossil-fueled power stations, problems with fuel supply and slow plant construction will plague the Soviets for the rest of the decade. These problems will inevitably result in continued interruptions in the supply of electricity and delays in bringing new generating capacity on line. By the late 1980s, further strains in electricity supply could result from prolonged operation of an increasing number of older fossil-fueled plants overdue for retirement.

Energy Production in the 1990s

26. In the 1990s, gas will continue to be the main source of additional energy:

— West Siberian gas will be by far the cheapest energy source. Gas output will be limited mainly by demand.

— The cost of oil development will continue to increase as exploitation in West Siberia moves to even smaller fields and offshore production becomes more important.

— Offshore development begun in the 1970s and 1980s will continue in the 1990s, notably in the deeper waters of the Caspian Sea and offshore Sakhalin. Thus far, however, there is no evidence that either area will become a major source of oil in the 1990s. Large imports of Western oil equipment and technology are likely to be necessary for rapid exploitation of offshore deposits.

— Oil may be found in unexplored areas of the Barents Sea and Kara Sea and in East Siberia. Major discoveries in these areas, although expensive to exploit, could become important in the 1990s.

— Technology for long-distance coal transportation and long-distance transmission of electricity from Siberia may substantially improve, which could permit a large increase in coal output by the latter part of the decade.

— A sizable share of electricity will be produced in nuclear plants, and the nuclear construction program may become more efficient.

Under these conditions, oil production will probably decline over the decade of the 1990s as oil development costs rise and as gas and nuclear power are increasingly substituted for oil.

Prospects for Energy Consumption

Overall Trends

27. The consumption of energy in the USSR will continue to be driven primarily by the overall growth

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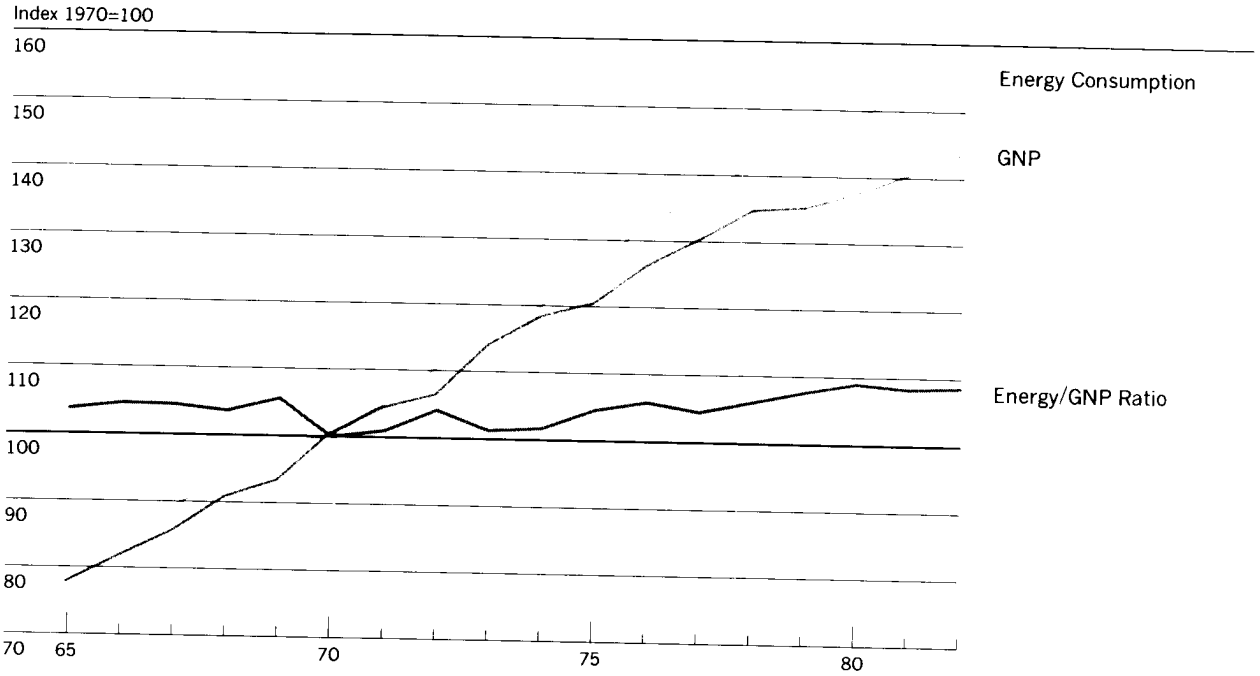
of the economy. The rate of growth of Soviet GNP has been declining, from an average of 3.7 percent in 1971-75 to 1.6 percent in 1979-82. We project average annual GNP growth rates of 2.5 percent in 1981-85 and about 2 percent in 1986-90. These projections assume, on the one hand, that severe shortages of critical inputs, including energy, do not develop, and, on the other hand, that major improvements in managerial efficiency are not achieved. Soviet energy consumption has risen as fast as or faster than Soviet GNP for many years (figure 4). In the past decade Soviet energy consumption increased by 4.1 percent per year and GNP by 3.0 percent. Energy consumption per unit of GNP increased by 9.1 percent in 1971-80, despite some Soviet efforts to conserve energy. In sharp contrast, after rising substantially during the earlier period of declining real energy prices, energy consumption per unit of GNP in the United States, Western Europe, and Japan has fallen by 20 to 25 percent since 1973 in response to the rise in real energy prices during that period.

28. A major cause of the rapid rise in Soviet energy consumption has been the extraordinarily rapid growth of the stock of plant and equipment—8 percent a year in 1971-75 and nearly 7 percent a year in 1976-80, or some two-thirds faster than in OECD countries, whose aggregate GNP grew at about the same rate as the USSR's.

Conservation and Substitution Problems

29. Institutional rigidities and production-oriented policies also have greatly hindered Soviet energy conservation. Unlike Western economies, the Soviet economy has been unable to take advantage of the many possibilities for conserving energy through improvements in management and small-scale expenditures by individual factories or households. The Soviets report that only a small part of energy use is accurate-

Figure 4
USSR: Energy/GNP Ratio



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ly measured and controlled at the point of use. The kinds of quick energy economies which were obtained in the West by improving insulation, lowering thermostat settings, and making many other small and inexpensive adjustments, are not available or apparently have been largely ignored in the USSR. The reason for this is partly that the Soviets have not organized themselves for this purpose and partly that energy users have had little incentive individually to take any action.

30. The Soviets are aware of the potential for conserving energy by investing in more energy-efficient equipment and structures, and apparently believe that energy can be conserved more cheaply than it can be produced. However, the realization of this potential saving has proved difficult since improving energy efficiency is only one, and by no means the most important, of the many goals Soviet machinery producers and builders must meet. Design improvements are being made, but slowly because of the disinclination to take any chances on not meeting production targets. Moreover, with the growth of investment expenditures substantially reduced because of general economic problems, the inclination to accept any delays in delivering equipment for the sake of improved energy efficiency may become even weaker.

31. Also detrimental to energy efficiency is the deep-seated Soviet practice of continuing to use outmoded capital equipment as long as it can be repaired. The average annual retirement rate of Soviet capital stock has been around 1.5 percent, less than half of that normal in Western practice, and, in contrast to the West, no major industry has scrapped its old equipment and replaced it with much more energy-efficient new equipment.

32. These fundamental constraints make it unlikely that Moscow can make rapid progress in energy conservation. In the long-term, however, steady and eventually substantial conservation probably can be achieved through improvements in the energy efficiency of new equipment. Moreover, results could be achieved more quickly if the Soviet Government gave a high management priority to energy conservation, and consequently were willing to sacrifice other economic objectives which might compete with it. In the January 1982 general price revision, the Soviet Government increased wholesale prices for crude oil and oil products by 130 percent and average wholesale prices for energy products by about two-thirds. These were the first changes in wholesale energy prices since 1968. Higher energy prices constitute a belated recognition of the large rise in domestic energy costs, and perhaps also of the surge in world market prices during the past decade. They cannot be expected, however, to have much direct impact on Soviet managerial decisions because these are mainly governed by other criteria, notably production plans.

33. There are fewer institutional and economic barriers to substitution of one type of energy for another. Converting industrial or power plant boilers from oil to gas, or to dual use, for example, is technically a fairly simple matter if the gas is made available. Given the relatively low cost of gas development, it makes good economic sense to substitute gas for oil and in some areas for coal.

Sectoral Energy Use

34. The slow upward trend in the energy-GNP ratio during the 1970s was partly the net result of a relatively rapid increase in the output of energy-intensive sectors. In addition, energy use per unit of output increased in agriculture and construction, mainly because of mechanization, more than offsetting a slow decline in energy consumption per unit of output in industry and electric power. Energy efficiency in transportation and in the trade and services sectors showed little change. Sectoral trends in energy use are shown in table 3.

35. In the 1980s, mechanization in agriculture and construction probably will proceed at a slower pace because of the general squeeze on investment funds, and energy efficiency in industry should increase at least as rapidly as in the past decade, given likely government efforts to introduce more energy-efficient equipment. The growth of transportation, trade, and services activity will be substantially slower, in line with the slower growth of GNP, and probably with little change in energy efficiency. In transportation, a further increase in the share of total freight carried on trucks will tend to reduce energy efficiency because trucks are far less energy-efficient than railroads. On the other hand, a shift toward diesel engines in trucks will tend to raise efficiency. These developments could result in a leveling off of the energy-GNP ratio over the decade without any major policy shift.

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Table 3
USSR: Estimated Energy Use by Major Sector

Million b/d oil equivalent

	1970	1980
Total	**16.2**	**23.8**
Oil	5.3	8.8
Natural gas	3.3	6.3
Coal	5.8	6.5
Electricity [a]	0.6	1.0
Other [b]	1.2	1.2
Industry [c]	6.3	9.3
Oil	1.4	1.8
Natural gas	1.8	3.7
Coal	2.2	2.6
Electricity [a]	0.4	0.7
Other [b]	0.5	0.5
Electric power [d]	3.2	4.8
Oil	0.7	1.7
Natural gas	0.8	1.2
Coal	1.5	1.8
Electricity [a]	NEGL	NEGL
Other [b]	0.2	0.1
Transportation	2.0	3.0
Oil	1.6	2.7
Natural gas	NEGL	NEGL
Coal	0.3	0.1
Electricity [a]	0.1	0.1
Other [b]	NEGL	0.1
Agriculture	0.7	1.4
Oil	0.5	0.8
Natural gas	NEGL	0.1
Coal	0.2	0.3
Electricity [a]	NEGL	0.1
Other [b]	NEGL	0.1
Other [e]	3.1	3.8
Oil	0.5	0.8
Natural gas	0.5	0.9
Coal	1.5	1.6
Electricity [a]	0.1	0.1
Other [b]	0.5	0.4
Nonenergy [f]	0.9	1.5
Oil	0.6	1.0
Natural gas	0.2	0.4
Coal	0.1	0.1
Other [b]	NEGL	NEGL

[a] Primary electricity from hydro and nuclear sources distributed according to shares for total electricity.
[b] Peat, oil shale, fuelwood, and other renewable energy sources.
[c] Including electricity and cogenerated heat supplied by captive power plants.
[d] For fossil-fueled power stations, fuel used for generating heat is distributed to the respective consuming sectors.
[e] Urban and rural residential and construction uses.
[f] Nonenergy consumption includes that portion of output used to produce lubricants, petrochemicals, and so forth.

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36. Oil consumption probably will grow more slowly during the next few years, and may level off late in the decade. Oil constitutes nearly 90 percent of the fuels used in transportation and over half of those used in agriculture. In neither of these sectors is substantial substitution for oil feasible. Their combined oil consumption probably will rise by around 1 million barrels per day over the decade. As mentioned above, however, there is large potential for substitution of gas for oil in electric power stations and industrial boilers, but implementation may be slow.

37. Progress in reducing oil usage in power stations is being held back by the need to use gas to offset shortfalls in coal production and the deterioration of coal quality. Currently, oil is the backup fuel in most boilers designed for coal, so oil consumption increases when coal supply problems arise. By bringing gas to these coal-fired plants, the Soviets are curtailing use of the standby oil and increasing power plant reliability, but this results in diversion of resources from the main substitution objective, replacement of oil with gas. Since consumption of substantial amounts of oil to offset coal shortfalls at power station boilers is likely to continue, there may be little net reduction of oil use in this sector during the 1980s.

38. In industry, there has already been great progress in boosting gas use. The oil share could decline even more, to perhaps as little as 10 percent in 1990 compared with 19 percent in 1980, but only with a sustained, high-priority effort. Such large-scale substitution, however, requires rapid expansion of the local gas networks so that most power plants and factories can have access to gas. Moreover, the growing difficulty of producing a mix of oil products consistent with trends in demand may also limit the rate of gas-for-oil substitution and push up the demand for oil.

The Oil Product Mix Problem

39. The pattern of Soviet energy consumption in the 1980s will result in increasing demand for light oil

products (diesel fuel, gasoline, and jet fuel), especially in transportation and agriculture, and possibly stable or declining demand for residual fuel oil, for which gas will be increasingly substituted. To meet these demands, the Soviets will have to either change their refinery mix or adjust their oil trade. But this will be difficult. Major changes in the refinery mix would require a large expansion of secondary processing facilities, and Moscow may have to import some Western equipment for the many catalytic cracking units that may be needed. So far, however, Moscow has not made the necessary investments; only two catalytic cracking units are being built, apparently with Soviet technology. There are also many constraints on adjustments through trade in crude oil, residual fuel oil, and products with Eastern Europe and Western countries. If adjustments in the refinery mix and in foreign trade do not keep up with changes in the pattern of demand, surpluses of residual fuel oil and deficits of light products will develop.

Foreign Trade in Energy

Soviet Policies

40. In developing its energy resources for the 1980s, Moscow will be trying not only to meet domestic energy requirements but also to provide critical energy exports to Eastern Europe and maintain or expand energy exports to the West for hard currency. The total volume of Soviet energy exports grew steadily in the 1970s, although at a declining rate, but leveled off in 1981-82. Soviet energy exports are of fundamental importance to Eastern Europe, representing some 27 percent of those countries' total primary energy consumption. Exports to the West constitute more than half of total Soviet hard currency earnings.

41. Energy exports in the 1980s will be affected by a complex mix of economic, bureaucratic, technical, and political considerations that neither we nor the Soviets can predict with any confidence. Faced with many uncertainties, Moscow characteristically tends to aim toward stability—which in this case probably means making provision at least to maintain and perhaps to increase slowly net energy exports over the 1980s. But unexpected energy developments—for example, large increases or decreases in world oil prices, shortfalls in planned Soviet energy production, or larger or smaller than planned increases in domestic energy demand—could either raise or lower future energy exports.

42. Among the economic considerations in Soviet energy export policy is the profitability of these exports in the longer term. Although available data on Soviet energy costs are few and their meaning is often unclear, there is sufficient evidence to indicate that exports of gas to the West are highly profitable and that exports of oil probably will continue to be more profitable than most nonenergy exports, despite rapidly increasing domestic costs. Gas exports, however, are limited by Western demand and by Western political considerations, while to raise or even to maintain oil exports requires large and growing investments, which must be bid away from high priority domestic projects.

Exports to Communist Countries

43. About 60 percent of current Soviet energy exports now go to Eastern Europe, Cuba, and other Communist countries. These exports have involved significant costs to the USSR—partly because under the Council for Economic Mutual Assistance (CEMA) pricing scheme, based on a five-year moving average of world prices, Moscow charged its clients oil prices far below world market levels, and partly because of the opportunity foregone to sell the oil in the West for hard currency. The slow phasing in of oil price increases was designed to spare the East European countries the necessity of rapid, disruptive economic adjustments. In 1978, Moscow also tried to spur a reduction in East European dependence on Soviet oil by promoting long-term energy strategies keyed to conservation, coal, nuclear power, and expansion of the unified electric power grid linking the East European countries and the USSR. The new oil price jumps in 1979-80, however, followed by Soviet hard currency problems in 1981, led Moscow to take stronger measures. Already having warned the East Europeans not to expect increases in planned oil deliveries during the 1981-85 Five-Year Plan period, in 1982 Moscow actually cut its oil exports to East Germany, Czechoslovakia, Hungary, and possibly Bulgaria by about 10 percent. Although the price of oil on the world market declined in 1982-83, the CEMA pricing formula had the effect of further increasing the price of Soviet oil to Eastern Europe.

44. The hard currency earning possibilities of Soviet client states are insufficient to replace much Soviet oil through imports from Western markets. The East European economies are already facing near economic stagnation, partly because of hard currency debt problems, the world recession, and the disruptions in Poland. While there is clearly a potential in Eastern Europe for some additional energy conservation and for substitution of Soviet gas for oil in industry, progress will be slow. Thus substantial additional reductions in Soviet oil deliveries would call for intensification of austerity measures in Eastern Europe and aggravate the danger of popular unrest. Nevertheless, we believe that the Kremlin would not be inclined to give Eastern Europe priority over its own domestic oil consumers or its hard currency oil exports should oil supplies become inadequate to meet all major Soviet objectives. Moscow might then make additional cuts in oil deliveries to Eastern Europe and trust to the coercive power of the East European regimes, buttressed by Soviet power, to maintain social order.

Hard Currency Exports

45. Moscow probably expects energy exports to continue as its principal source of hard currency earnings. The prospects for most other hard currency exports—for example, wood, machinery, and minerals—range from fair to poor. Even hard currency earnings from arms deliveries will be hard to sustain as major Soviet customers confront their own payments problems. There is no evidence that Moscow is mounting a major program to reduce Soviet dependence on energy as a source of hard currency earnings. There are many ambiguities in Soviet policy concerning hard currency energy exports. Moscow cut oil export volume in 1979-80, but less than the rise in oil prices, so total earnings increased. In some years, including 1981, export earnings have declined and imports have been cut, especially in the case of machinery and equipment. How much Moscow would be willing to reduce hard currency imports, if maintaining them meant serious domestic oil shortages, would depend on many factors, including the food situation, the prospects for oil price changes, and the state of East-West relations. Clearly, however, some hard currency imports are of great importance to the economy and would be maintained even at the cost of significant disruptions in domestic production.

46. The share of natural gas in total Soviet energy exports for hard currency will increase in the 1980s and probably in the 1990s as well. Completion of the new Siberia–to–Western Europe gas pipeline will permit an expansion of Soviet gas exports of about two-thirds under existing contracts (that is, not including Italy), and eventually by nearly 100 percent if the pipeline is used at capacity. Moscow has ample gas reserves to support a second, or even a third, pipeline to Western Europe, should there be sufficient demand, but these are not likely to be built until the 1990s if at all. Some decline in oil exports seems likely, particularly in view of rapidly rising costs of oil production. Even so, Moscow probably will consider that it needs to maintain a substantial level of hard currency oil exports because, unlike gas, oil can be sold on a small scale and in many different markets, and is politically less visible than the massive gas projects. Moreover, at least through the 1980s, Moscow will still depend on oil exports as an important source of hard currency.

Energy Investment

47. Energy investment is surging because of both rising investment costs of new production and the need to make up for past neglect in some areas. In the 1960s and most of the 1970s, Moscow held down the share of energy in total investment by meeting the minimum needs of the top priority energy sectors at the expense of others. This is no longer possible; investment costs are increasing in all areas of energy, in some cases very rapidly. Energy investments for 1981-85 are likely to be 60 percent higher than in 1976-80 and will probably constitute 19 percent of total capital investment, compared with 14 percent in 1976-80. Investments in gas are planned to increase by two-thirds in 1981-85 (table 4). Based on results for 1981 and 1982 and our analysis of drilling requirements and costs, oil investments will nearly double. A rough allowance for investments in oil refining (which Moscow classifies under chemicals) and energy-related infrastructure combined would probably raise the overall energy share to well over 20 percent.

48. Energy investment will continue to grow rapidly during 1986-90 if present policies emphasizing energy production continue. If oil production were held near 12.5 million b/d, oil investment probably would again about double; at a minimum, should the

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Table 4
USSR: Energy Investment [a]

Billion 1973 rubles

	1976-80	1981-85 Projected	Projected: 1986-90 [b]	
			High Production	Low Production
Total	88.0	140	171-188	143-157
Oil [c,d]	26.4	51	90-107	83-97
Natural gas [d]	32.2	54	32	26
Coal	9.7	12	16	12
Electric power	19.7	23	33	22
Energy investment as a share of total new fixed investment (*percent*)	13.9	19 [e]	21-23 [f]	18-19 [f]

[a] Excluding investment in the minor fuels (peat, oil shale, and fuelwood), which amounted to about 1 billion rubles in 1976-80.
[b] High and low production estimates correspond approximately to the policy scenarios described in section VI below. Projections are subject to a considerable margin or error.
[c] Excluding investment in oil refining, which is included in petrochemical and chemical investment in Soviet statistics.
[d] Including estimated investment in pipelines.
[e] Assuming that total new fixed investment is 4 percent above plan.
[f] Assuming a 12-percent increase in total new fixed investment over 1981-85.

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quality of newly developed fields prove sufficient to greatly slow the decline in well flow rates, investment would increase about 75 percent. Investment in coal and electric power would probably increase more rapidly. A substantial decline is likely in gas investment, however, in sharp contrast to the large increase in 1981-85, as the current exceptionally large long-distance pipeline program is completed. Under production-oriented policies, the share of energy investment in total investment would continue to increase, but probably less rapidly than in 1981-85. If Moscow allowed the growth of energy production to slow, however, and oil production to decline—for example, by 1 million b/d—it could stabilize or even slightly reduce the energy investment share during 1986-90. The considerations that will determine Moscow energy investment policies are discussed in the next section.

49. Soviet energy investment probably exceeds US investment, which in turn is larger than the combined total for the rest of the non-Communist world. Both the USSR and the United States devote about 20 percent of total investment to energy, and the dollar value of total Soviet investment is probably somewhat above the US level. However, Soviet GNP is not much over half the US level. Energy investment trends have been upward in both countries, but their timing differs. While US investment in oil and gas development took large jumps immediately after both the 1973 and the 1979 price increases, the main surge in Soviet oil and gas investment did not begin until the late 1970s. Moreover, Soviet energy investments, and those for oil development in particular, will continue to increase rapidly throughout the 1980s, while those in the United States apparently have already leveled off.

50. The larger magnitude of Soviet energy investment compared with that of the United States does not reflect differences in energy resource endowment; on the whole, these differences clearly favor the USSR. Well flows for both oil and gas on the average are much higher in the USSR than in the United States, where the larger fields have been in decline for a long time, and where high prices justify the development of very small fields with well flows far lower than anything the Soviets are exploiting. Rather, the high Soviet investment costs appear to reflect systemic and policy differences. Because Moscow delayed for years taking up the energy problem as a matter of high

priority, investment requirements accumulated. Moreover, the inability of the Soviet management system to make much progress in energy conservation put nearly the entire burden of adjustment on energy supply. Consequently, the USSR must increase energy production much more rapidly than the United States, which requires massive investment.

Energy Policies in the 1980s

51. In its energy policies for the 1980s, Moscow will have to balance several objectives that will be difficult to achieve simultaneously. With regard to energy production, the Soviet leadership will be trying to hold investment costs to a level which does not divert so much scarce capital that it creates serious problems for other economic sectors and for the growth of the economy as a whole. With respect to energy consumption, Moscow will try to avoid energy shortages disruptive of production processes over long periods. With respect to foreign trade, it is important to the leadership to maintain a level of energy exports sufficient to avoid severe political problems in Eastern Europe and to ensure that at least the most essential imports from the West can be paid for.

52. In the current Five-Year Plan (1981-85), Soviet energy policies are primarily production oriented. The large planned rise in energy investments indicates a willingness to pay for the rapidly rising costs of developing energy resources in order to cover domestic and export needs. Planned investments should be sufficient to raise oil production to near 12.5 million b/d by 1985, reflecting a probably realistic view of oil drilling requirements. Gas production in 1985 should be around 10 million b/d oil equivalent, below plan but still sufficient to meet demand. Coal production in terms of energy content will be about constant and nuclear power production will grow, but less than planned. There is a great deal of talk, but little action, to stimulate energy conservation. Although gas-for-oil substitution is being pushed hard, it is not progressing as rapidly as planned. Net energy exports will probably be maintained or slightly increased through 1985.

53. Energy prospects in the second half of the decade are much more uncertain than those for 1985, not only because of uncertainty regarding production, conservation, and substitution is substantially wider, but also because Soviet energy policies may change. With the rapid growth of energy investment in the current Five-Year Plan period, it is becoming increasingly difficult to fund new programs in other areas. Consequently, it is reasonable to expect that political opposition to costly production-oriented energy policies will increase. Although energy investments are only part of the picture, in the current Five-Year Plan their share of the total is increasing by about 5 percentage points at a time when total investment is growing very slowly—an increased claim comparable to that given to agriculture about a decade earlier. Investment in heavy industry is increasing slowly; efforts are being made to rebuild the transportation sector after decades of neglect; agriculture is holding its own in investment allocations, and together with energy is taking 40 percent of the total; investment in consumer-oriented sectors—housing, light industry, and services—is probably falling in absolute terms. Continuation of production-oriented energy policies would probably require a further increase in energy's share of total investment during 1986-90, squeezing investment in other economic sectors and jeopardizing objectives for raising living standards or possibly even military production.

54. Under these circumstances, the Soviet leadership might consider alternative policies to achieve substantial savings in energy investment during the next Five-Year Plan. In order to save on investment, Moscow must cut the demand for energy, especially oil, so that it can meet its domestic and priority export needs with less growth of energy production. Limiting energy consumption in general, and oil consumption in particular, would mean greater emphasis on energy conservation and interfuel substitution. The shift to a more conservation-oriented policy could be attractive in view of Soviet expert claims that it is much cheaper to conserve an extra unit of energy than to produce it. The issue is certain to be a highly contentious one, and we cannot predict the outcome of the debate.

55. To illustrate how a production-oriented or a consumption-oriented policy might work out, notional projections of energy balances for 1990 are set out in table 5. To provide a basis for comparison, both of the 1990 balances are constructed on the assumption that GNP will grow at an annual rate of 2 percent during 1986-90. In the production-oriented scenario, drilling and other investment in the oil industry increases rapidly enough to maintain oil production at 12.5 million b/d during 1986-90. This policy is more likely

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Table 5
USSR: Energy Balances Through 1985 and Possible 1990 Scenarios

Million b/d oil equivalent

	1980	1982	Projected 1985	Illustrative Scenarios 1990	
				Production Emphasis [a]	Consumption Emphasis [a]
Production					
Total energy	28.2	29.7	31.8	34.7	32.9
Oil	12.0	12.3	12.5	12.5	11.5
Gas	7.2	8.3	9.8	11.5	11.2
Coal	6.7	6.7	6.6	6.8	6.6
Nuclear/hydro	1.1	1.2	1.6	2.6	2.3
Other	1.2	1.2	1.3	1.3	1.3
Consumption					
Total energy	23.8	25.3	27.1	29.9	28.8
Oil	8.8	9.1	9.3	9.6	9.3
Gas	6.3	7.3	8.6	9.9	9.6
Coal	6.5	6.6	6.4	6.6	6.4
Nuclear/hydro	1.0	1.1	1.5	2.5	2.2
Other	1.2	1.2	1.3	1.3	1.3
Net exports					
Total energy	4.4	4.4	4.7	4.8	4.1
Oil	3.2	3.2	3.2	2.9	2.2
Gas	0.9	1.0	1.2	1.6	1.6
Coal	0.2	0.1	0.2	0.2	0.2
Electricity	0.1	0.1	0.1	0.1	0.1

[a] These figures are illustrative results of alternative policies; they do not represent a range of forecasts.

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to be followed, the better the quality of the new oil fields available for development. By the time the new Five-Year Plan is completed, Moscow should have better information on the technical possibilities and problems of oil development. In the scenario, gas production continues to rise in line with domestic and export demand, while nuclear power and coal production increase as much as is technically feasible. At the same time, although no extraordinary measures are taken to push conservation, the energy-GNP ratio levels off. The result is a level and composition of energy production that meets domestic requirements and permits a small increase in net energy exports as rising gas exports more than offset the slight decline in oil sales.

56. In a scenario emphasizing limitation of energy consumption, Moscow puts teeth into energy conservation policies by making energy savings a top priority management objective and by severely rationing energy allocations to producers and consumers. Gas-for-oil substitution is pushed hard, especially in industry and electric power stations, in support of which the development of local gas distribution networks and oil cracking facilities would be given a high priority. Substantially less investment is allocated to energy production, especially oil. As a result, production of oil declines to perhaps 11.5 million b/d, coal production drops slightly, and the increase in nuclear power production is slower. In this scenario, if Moscow were able to hold the annual growth of energy consumption to about half the rate of growth of GNP, domestic energy needs could be met, but only with a fairly substantial decline in oil exports.

57. Continuation of production-oriented policies, while minimizing problems of supplying energy to the domestic economy and Eastern Europe, and permitting hard currency energy exports to be maintained, would have adverse affects on other areas of the Soviet economy. There would be a further increase in the share of energy in total investment—to perhaps 22 percent—except in the unlikely case in which production conditions were highly favorable in all major energy sectors. Probably about half of the likely increase in total investment in 1986-90 would go to energy. If heavy industry and agriculture continued to receive priority in the allocation of the remaining investments, investment in other consumer-oriented sectors would probably fall in absolute terms. With a decade of such declines, living standards would probably begin to deteriorate. If Moscow could not accept the decline in living standards brought about by this investment pattern, and instead decided to cut investment in heavy industry for several years, the competition between defense and civilian uses of investment funds would become more severe, and the growth of either military programs or total capital investment would have to be slowed.

58. Energy policies emphasizing the limitation of energy consumption could ease the burden of energy investments—the energy share of total investment would level off or decline—and consequently would free up more investment funds for other sectors, but would involve risks of serious difficulties in energy supplies for domestic use and exports. Although we cannot be confident about estimating the effects of strong—even unprecedented—conservation policies because they have never been tried in the USSR, our knowledge of the way the Soviet planning and management system operates gives reason for doubt. There is a substantial possibility that the Soviet political leadership would underestimate the difficulty of achieving conservation objectives. In setting an energy production plan, the leadership cannot ignore geological conditions and engineering analysis, which largely determine production possibilities. But with respect to energy conservation, expert judgment as to what is technically feasible may have little bearing on what can be achieved, given the economy's systemic problems. An energy plan in which meeting domestic and export objectives required large-scale energy conservation thus might well turn out to be unbalanced. It would then be difficult to avoid widespread energy shortages and a large decline in energy exports. Although there is little doubt that energy is used inefficiently in many parts of the Soviet economy, this inefficiency does not easily translate into usable opportunities for conservation. Moscow has the power to force cuts in energy use, but this may be at least in part at the cost of slower growth of output and reduced labor productivity. Accelerated energy conservation also could be achieved through investment in new equipment of improved design, and by accelerated retirement of existing equipment. But such improvements will be limited by the investment slowdown, sluggish technological change, and unwillingness to accept even temporary declines in output in industries.

59. In order to minimize the problems that are likely to result from the two fairly extreme energy policies, Moscow is likely to adopt a mix of policies that have elements of both scenarios, or some compromise policies. Policies also will be adjusted to try to correct problems as they arise, and in response to unexpected developments such as a large increase or decline in international oil prices. Both in its initial policy choices and in later adjustments, Moscow will be trying to achieve a reasonable balance between its objectives of minimizing the energy investment burden, meeting domestic energy needs, assuring energy exports sufficient to maintain reasonable economic performance in Eastern Europe, and earning enough hard currency to cover at least high priority imports.

60. Although the policy mix is likely to be an admixture of those specified in the two scenarios, the notional projections in table 5 should not be viewed as bounding the range of possibilities because production, consumption, and exports of the various forms of energy are interrelated. Moreover, the uncertainties regarding Soviet energy policy and the technical conditions for energy production are not the only factors preventing a firm projection of energy production, consumption, and trade. Faster or slower growth of GNP than the assumed 2 percent would raise or lower energy demand, consequently forcing modifications of policies concerning production, conservation, or trade. Changes in real world energy prices would affect both the profitability of energy investment and the volume of energy exports required to maintain a given value of imports.

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61. The indications of Soviet intentions for energy policy in 1986-90 are sparse, mixed, and inconclusive. The possibilities for and benefits of energy conservation are receiving growing attention, but it is not yet clear how desires are to be translated into actions. There is no reason to doubt that the Soviets intend to push gas-for-oil substitution as hard as they can. As to intentions for oil production, most Soviet public statements have indicated in general terms that oil production was expected to level off. Moreover, completion of the new long-distance West Siberian oil pipeline now under construction would provide the capacity to transport enough West Siberian oil to keep national output roughly constant. In the past year or so, however, private statements by some Soviet officials, although giving no forecasts, suggest that a decline in production may occur. It is highly probable that the issue of oil production for 1986-90 is still open. With respect to foreign trade in energy, there are no indications of future policy trends. We should obtain early indications of Soviet policy directions as information on the new Long-Term Energy Program, which has already been drafted, is revealed. In addition, energy policy, and its role in investment policy, will be debated at forthcoming Party Plenums. A list of indicators of key Soviet energy trends and policy decisions that should be monitored by the Intelligence Community is at inset.

Key Indicators of Soviet Energy Policies

Information on Soviet plans for the energy sector during the 12th Five-Year Plan period (1986-90) is unlikely to be released by Moscow until well into 1986 at the earliest. Even then official announcements will probably be limited to planned production of the various forms of energy, and perhaps a single figure for total investment in the fuel and energy complex (as was the case in 1981-85). Some data on investment in individual energy sectors may be published in specialized journals throughout 1986, but only on a hit-or-miss basis.

Some earlier indications of likely Soviet energy policies should become available during 1984-85, however, enabling intelligence analysts to reduce the range of uncertainty about the likely Soviet energy policy mix in 1986-90.

For example, indications that Moscow was continuing production-oriented energy policies would include:

- Oil production continues to slowly increase or to stabilize.
- Additional pumping capacity for long-distance oil pipelines is being added.
- Work begins on a new long-distance oil pipeline.
- West Siberian development drilling is expanding rapidly into new areas.
- The East European countries are receiving assurances that Soviet oil supplies will not be cut further.

On the other hand, early indications of changes in the direction of a more consumption-oriented energy policy might include:

- Oil production begins to decline.
- Oil development drilling in West Siberia slows down.
- Gas development moves into more northerly West Siberian fields sooner than expected.
- A rash of energy conservation decrees is issued.
- Forceful articles are prepared on the need for producing more energy efficient equipment.
- Many Soviet managers complain about cutbacks in fuel allocations.
- The East Europeans are told to expect possibly substantial cuts in Soviet oil deliveries.

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62. While there is agreement on the general energy trends and policy choices, there is a range of judgments on how much difficulty the USSR is likely to experience in achieving an acceptable balance among its main energy objectives. Some analysts, including those in DIA, believe that Moscow has correctly assessed both demand trends and the technical requirements for energy production, and consequently will produce as much oil as is necessary to meet domestic and export needs. They believe that if progress in energy conservation and interfuel substitution proves to be slow and Moscow considers it necessary to maintain oil exports, the Soviets would keep oil production fairly constant. They realize that the burden of energy investment may continue to increase, but believe that the increase will not be large. Moreover, Moscow may believe that the economic benefits from incremental energy investments—especially the resulting hard currency sales—are such, on balance, as to enhance the overall productivity of the economy. Other analysts, including those in CIA/DDI, believe that rapidly rising investment costs are likely to lead to a gradual fall in oil production after 1985. They also believe that the Soviet leadership will, as in the past, overestimate the possibilities for energy conservation and interfuel substitution. Consequently, shortfalls in oil supply could develop that would disrupt the domestic economy and squeeze exports. Because opportunities to reduce oil deliveries to Eastern Europe and to increase gas sales are limited in the 1980s, these analysts project a decline in hard currency earnings from energy exports if oil and gas prices are unchanged.

The Potential Impact of Western Actions

63. Western actions can substantially affect Soviet investment costs and/or hard currency earnings during the 1980s and beyond. Specifically:

- A willingness to import large amounts of Soviet gas—enough, for example, to fill an additional Siberia–to–Western Europe pipeline of the size of the one recently laid would, at present gas prices, provide additional hard currency earnings of nearly $5 billion per year.
- Development of the deeper offshore oil deposits in the Arctic, the Caspian, and Sakhalin, depend heavily on Western equipment and technology. Although these deposits will not have a major impact on Soviet oil production in the 1980s, some of them may become important in the 1990s.
- More generally, as oil exploitation involves deeper deposits and more sophisticated forms of secondary and enhanced recovery, various kinds of Western technology will increasingly be needed.
- Although the USSR will probably become less dependent on the West for large-diameter pipe production and turbine-compressors, imports from the West will involve lower costs and greater efficiency. Moreover, the attractiveness of the Soviet market to Western equipment producers may give Moscow opportunities to use the offer of additional equipment purchases as a bargaining chip in any negotiations on new gas projects.
- Finally, being severely strapped for investment resources, the USSR would seek and greatly benefit from large Western loans to finance imports for energy development.

Implications for US Interests

64. Soviet energy developments have important implications for US and Western interests both through their impact on Soviet economic performance and resource allocation and through the potential handles of influence that these developments may give to both the West and the USSR.

65. To the extent that Soviet economic growth is slowed either indirectly because of the rapidly rising cost of energy development, or directly because of energy shortages, Moscow's policy choices in allocating resources among the competing objectives of defense, consumption, and investment, will become more difficult. Although the military will probably retain its premier position in the resource competition, it cannot be fully insulated from the economic problems. Occasionally, shortages of key industrial materials and transportation bottlenecks due largely to insufficient investment, have slowed output in some defense-related plants. Military procurement and other investment at times has been restricted to accommodate increased investment in high priority civilian areas, such as agriculture and energy. Leaders of the Soviet

military-industrial complex recognize that in the longer term, continued growth of the heavy industrial base is essential to expansion and modernization of military output. Thus, while there is little direct competition for resources between the energy and the military industries, the increasing investment burden of assuring adequate energy supplies may indirectly be a factor slowing military expansion.

66. Soviet dependence on the West for important energy markets, especially gas, and for energy equipment and technology, gives Western countries some important potential policy handles. As mentioned above, the expansion of Soviet gas production will depend partly on the volume of exports to Western Europe, especially in the 1990s. Many billions of dollars in export earnings or, should gas be substituted for oil in energy exports, major savings in investment costs, would accrue to Moscow. The importance of imports of Western oil and gas drilling and processing equipment is likely to grow in the late 1980s and especially in the 1990s as Moscow depends increasingly on exploiting deeper, more complex deposits. Most of the needed equipment is available from Western sources outside the United States.

67. By the same token, Moscow's continued ability to export substantial amounts of oil to the West, and especially its strong position as a low-cost, potentially very large supplier of gas to Western Europe, gives it strong assets with which to bargain with Western countries, and a potential basis for enhancing its economic ties, and at least indirectly its political influence in Western Europe.

68. We expect Soviet gas supplies to account for roughly 20 percent of total gas consumption in Western Europe and one-third in West Germany and France by 1990. Despite plans to develop energy supply alternatives, West European reliance on Soviet gas could increase substantially in the 1990s. The current comfortable supply-demand outlook through 1990 has reduced the perceived urgency of planning additional gas supplies for the following decade. If competitive alternatives are not found, or if the West Europeans are unwilling to pay a premium for alternatives, the Soviet Union would be in a good position to capture a greater share of the West European gas market in the 1990s.

69. Western Europe will need to contract for additional gas supplies in the 1990s. If industry midrange demand estimates prove accurate, indigenous continental gas production plus gas available under existing import contracts will fall some 50 to 80 billion cubic meters short of requirements by the year 2000. The Soviet Union could supply an additional 10 to 15 bcm from existing pipelines. If it should supply even one-half of the West European demand gap, an additional pipeline of the size of the one now under construction would be needed, and dependence on Soviet gas could approach 50 percent for major countries of continental Western Europe—well in excess of the 30-percent dependence that we and some West European governments regard as a critical threshold for political risk. Development of major Norwegian fields, especially the Troll field, could cover most additional West European gas needs in the 1990s, but only if exploration and technical analysis are not long delayed—development of new areas of the North Sea will take about 10 years—and if buyers are willing to commit themselves to pay a relatively high price for the gas. If new Norwegian gas can be developed for the late 1990s, and Dutch gas production can be maintained in the meantime, there is a good chance that a new Soviet pipeline will not be needed, although Soviet gas deliveries through existing pipelines probably will continue to increase. Other potential alternative sources of additional gas (Algeria, Libya, Cameroon, Nigeria, Qatar, and Canada) either would probably cost at least as much as Norwegian gas or be considerably less secure.

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