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Prospects for the Soviet Gas Condensate Industry

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A Research Paper

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Prospects for the Soviet Gas Condensate Industry [redacted]

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A Research Paper

This paper was prepared by [redacted] Office of Global Issues. Comments and queries are welcome and may be directed to the Chief, Resource Analysis Branch, OGI, [redacted]

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Prospects for the Soviet Gas Condensate Industry

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Key Judgments

Information available as of 1 March 1984 was used in this report.

After three decades of steady increases, the rate of Soviet oil production growth has begun to slow and may level off and subsequently decline during the last half of the 1980s. One of the few bright spots in the Soviet oil picture for the 1980s is the expected growth of the gas condensate industry. Indeed, potential increases in production of condensate, a liquid hydrocarbon found in both oil and gas fields, may determine whether the Soviets reach oil production goals—which now include condensate—or suffer a further slide in oil output later in this decade.

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Although the Soviets do not publish condensate reserve data, information we have pieced together suggests reserves are ample to support major increases in production beyond the current level of about 660,000 barrels per day (b/d) or 24 million tons per year using a conversion factor of 10 barrels of condensate per ton. Soviet planners are now attempting to solve many of the condensate sector's problems with an eye toward greatly expanded production by the end of the decade. We believe the Soviets plan an estimated 80,000- to 110,000-b/d annual increase in condensate production in that time frame. Our analysis indicates the Soviets will be able to add this amount of condensate each year from newer fields; declining production from older oil and gas fields will most likely limit the net annual increase to an average 50,000 to 60,000 b/d, enough to boost annual condensate production to 1 million b/d by 1990.

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To successfully implement future condensate production and processing projects, however, the USSR must substantially increase its purchases of Western equipment and technology. As is the case throughout its oil industry, the USSR's condensate technology is about 10 to 20 years behind that of the United States, creating a substantial dependence on Western designs and equipment for recovering and processing condensate. Several of the most important future condensate producing fields have extremely high levels of sulfur and carbon dioxide and will require expensive and complex extraction and processing equipment that Soviet industry is currently unable to manufacture. For the foreseeable future, the USSR will have to rely heavily on the West—particularly France, West Germany, Japan, Italy, and the United States—for much of the equipment and know-how to realize its condensate production potential.

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Increased Soviet condensate production will ease the burden of supplying oil to East European satellites and will aid the Soviets in maintaining important hard currency earnings generated from petroleum exports to Western and Third World customers. Condensate's rising production totals will also supply the Soviets with greater amounts of more valuable light petroleum products—such as motor gasoline, marine diesel, and kerosene—which are in short supply in the domestic economy and are in greater demand on the world market than heavier fuel oil types. As with the rest of the Soviet oil industry, however, these economic gains will require an increased dependence on Western equipment and technology to produce and process gas condensate.

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Prospects for the Soviet Gas Condensate Industry

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Introduction

After three decades of large and steady increases, Soviet oil production growth has begun to slow and—depending on the investment choices Moscow makes—may level off and subsequently decline during the last half of this decade. Soviet oil production, which includes gas condensate in the Soviet reporting system, averaged about 12.3 million barrels per day (b/d) in 1983, only about 300,000 b/d more than in 1980.[1] Though still posting small annual increases, the Soviet oil industry has yet to reach an annual plan target this decade, and output has been growing at less than 1 percent since 1980.

If the Soviets are to avoid an oil production decline during this decade, a large part of the burden will fall on the relatively obscure gas condensate industry. Soviet crude oil production has remained stagnant since the late 1970s and that statistical gains registered since then are due almost entirely to expanding condensate production. Many also believe that future production goals could well be out of reach if the condensate industry is unable to provide steadily rising volumes of gas liquids for inclusion in the "oil" statistics.

Condensate production is one of the few potential bright spots for the Soviet oil industry over the balance of the 1980s. Besides partially compensating for the expected downturn in crude oil production, expanded condensate production could provide new supplies of lighter petroleum products for both foreign sales and domestic use. There are, however, substantial problems in the Soviet condensate industry that must be dealt with satisfactorily by Soviet planners if the promise of increasing condensate production is to be realized. In light of its growing role and higher priority in Soviet energy plans, an accurate assessment of the prospects for the Soviet gas condensate industry is important in understanding the USSR's energy supply situation over the rest of this decade.

Condensate in the Soviet Economy

Until recently, the Soviets neglected the important energy and chemical value of condensate and did not make extensive use of it in the economy. Large amounts were flared, left in natural gas reservoirs, or simply lost due to lack of processing facilities. Recognizing its obvious value and versatility in the last decade, the Soviets are now paying much greater attention to condensate. The Soviets claim that 1 ton of condensate is equivalent to 1.5 to 2 tons of oil for fuel purposes and that 1 ton of processed condensate is equivalent in value to 3 to 5 tons of refined oil. Soviet journals state that condensate products are used as fuels and in the petrochemical industry to produce a great variety of chemicals, solvents, dyes, and plastics (figure 1).

Where processing facilities are still unavailable and in areas that are too remote to justify pipeline or railway construction, condensate is often burned directly for fuel. Large amounts of unprocessed condensate are often used with dry natural gas to fuel electric power plants and other industrial plants. Liquefied gases from condensate are also used for household heating in sparsely settled rural areas. To make better local use of condensate, the Soviets have begun to assemble small condensate processing plants to provide local sources of motor and diesel fuel and eliminate long-distance transport of fuel supplies.

Processed condensate also plays an increasingly important role in Soviet transportation, refining, and petrochemical industries. The USSR's growing fleet of vehicles is making increased use of diesel fuel and gasoline produced from condensate. Soviet open sources state that over 1,000 cars in Moscow alone are fueled by a benzene-propane fuel mixture processed from condensate. A prominent example of condensate's versatility as a petrochemical feedstock is the Orenburg complex in the southern Urals where condensate is transported by pipeline to the Salavat

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Gas Condensate:
Definitions and Terminology

Gas condensate, also called natural gas liquids (NGL), is a hydrocarbon occurring either in natural gas or oil-associated reservoirs of great depth and high pressure. Condensate is normally in the vapor phase, but condenses as reservoir pressure is reduced during extraction. Processed components of condensate such as propane, butane, and pentane are used as petrochemical feedstock, motor gasoline, bottled gas, and raw materials for other industrial uses. Although condensate—and the lighter, higher priced hydrocarbons produced from it—is extremely valuable, its volatile nature makes it difficult and expensive to process, transport, and store, and frequently restricts its use for industrial purposes.

Since condensate is neither natural gas nor crude oil but can be produced from both, output can be reported in a number of formats. In most countries, liquids separated from natural gas at the oil or gas wellhead (lease or field condensate) are reported as crude oil production; those produced in natural gas processing plants are reported as NGL. In some countries, however, both the liquids produced in natural gas processing plants and at the field are counted as crude oil production.

Soviet condensate production reporting is even more difficult to interpret. Reporting on associated and nonassociated NGL production totals has all too often been inconsistent, with numerous statistical contradictions. Moreover, the liquids that have been included under the condensate category have changed over time, making it extremely difficult to construct an accurate picture of developments and trends in the industry. We believe that the NGL added to Soviet crude oil production figures include: (a) condensate separated from gas in gas condensate fields, (b) liquids or field condensate separated from associated (with oil) natural gas, and (c) often, but not always, the total NGL production derived from natural gas processing plants (figure 1). All references to condensate in this report consequently encompass these three categories, a somewhat different definition than is the case in most other condensate producing countries.

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An additional complication in working with Soviet condensate figures is converting them from Soviet weight measurement in tons to the more common Western practice of volumetric measurement in barrels. Although the standard industry conversion factor for undifferentiated crude oil is 7.33 barrels to the ton, we believe using this figure would substantially understate Soviet condensate reserves and production. The conversion factor used by the Soviets has varied widely from year to year and field to field. A ratio of 10 barrels of oil to 1 ton of condensate is, in our judgment, a reasonable conversion value for Soviet condensate figures.

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petrochemical plant in the Bashkir ASSR and blended with crude oil to be processed into motor gasoline. Ethane, a liquid petroleum gas component of condensate, is also carried via pipeline to supply a petrochemical complex at Kazan'. Additional condensate pipelines are planned or under construction to other gasoline plants in the Urals. Two giant petrochemical plants under construction at Tobol'sk and Tomsk in West Siberia will also use condensate from the middle Ob' region and Urengoy to produce gasoline, natural gas liquids, synthetic rubber, and plastics.

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The Reserve Base

Moscow has never published official condensate reserve totals, but they are undisputedly immense. On the basis of recently published Soviet data,

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and engineering calculations of the condensate content of Soviet gasfields, we estimate current *proved reserves* to be in the range of 16-20 billion barrels—about one-fourth the size of Soviet

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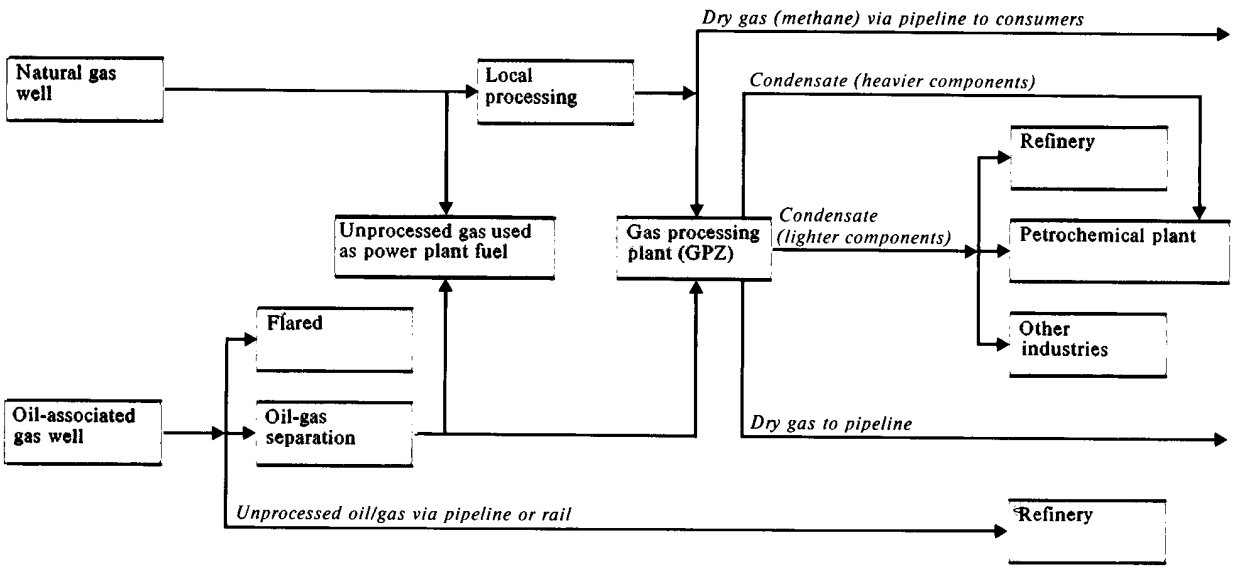
Figure 1
Soviet Gas Condensate Processing



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proved crude oil reserves (see table). We expect the proved reserve base to grow rapidly over the rest of the decade as development of the supergiant West Siberian gasfields progresses. Whatever its exact size, the reserve base is more than large enough to support over 60 years of production at an estimated current output level of 660,000 b/d. Thus, as is the case with crude oil, future condensate output will be limited not by the size of the resource base, but by the Soviet ability to extract and process the condensate and supply it to industrial consumers.

Condensate reserves are widely distributed in the USSR, with numerous deposits in West Siberia, Komi ASSR, Central Asia, and the Ukraine (see map at end of text).

Estimated Soviet Gas Condensate Reserves

Billion barrels

Region	Proved Reserves
Soviet Union	16 to 20
West Siberia	6.85 to 10.9
Middle Ob'	1.35 to 2.7
Northern West Siberia	5.50 to 8.2
Non–West Siberia	5.1 to 13.15

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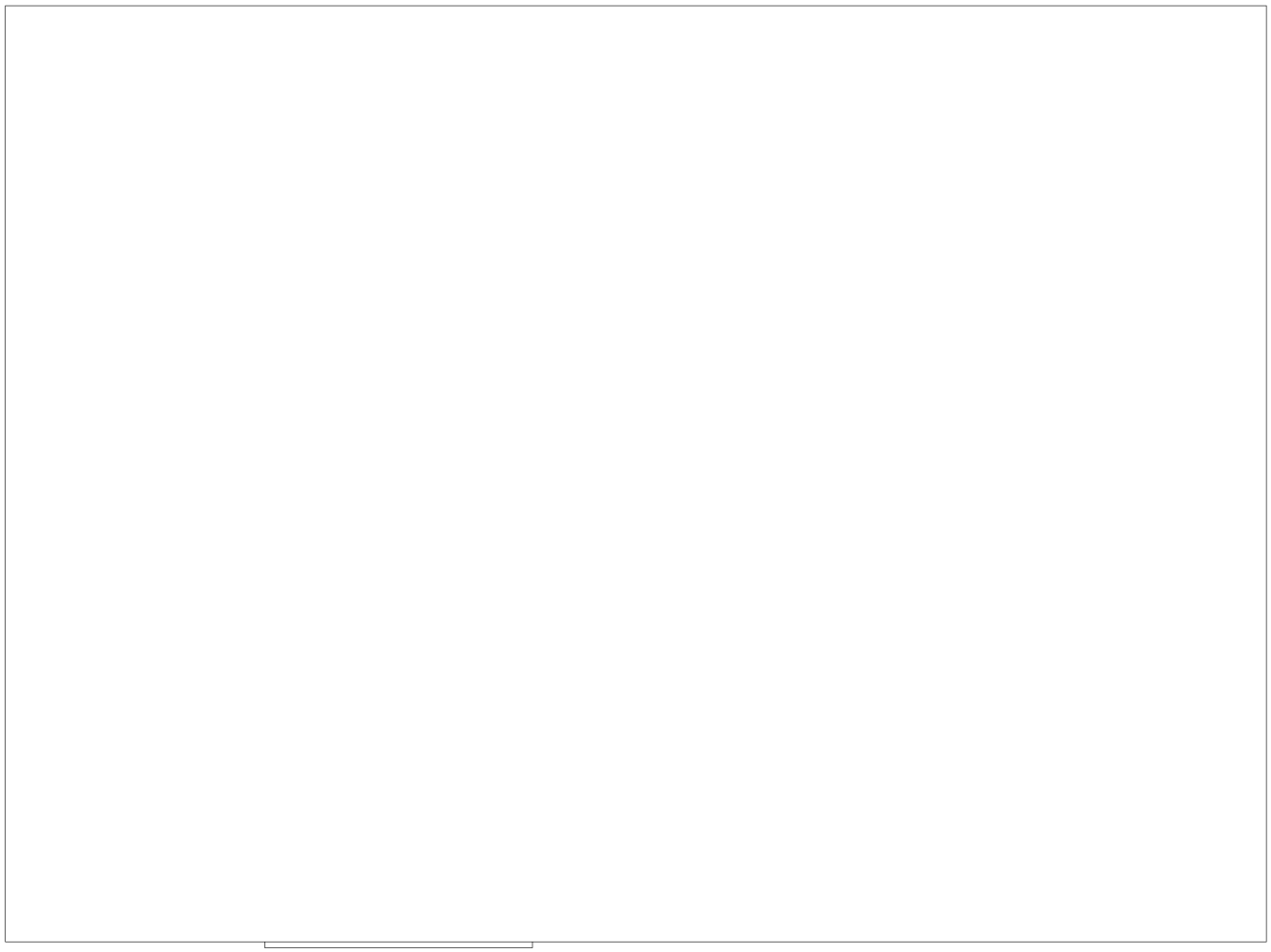

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a large part of condensate reserves is situated in a relatively small number of fields, and that Orenburg, Vuktyl in Komi ASSR, Lyantor in the middle Ob' region, and Urengoy and Zapolyarnyy in North Tyumen contain over 50 percent of the country's explored reserves. West Siberia contains from about 40 percent to perhaps as much as two-thirds of all Soviet condensate resources. Our own analysis of open-source reporting indicates that West Siberia contains some 50 to 60 percent of national condensate reserves—an estimated 1.3-2.7 billion barrels associated with oilfields and from 5.5 to over 8 billion barrels with gasfields. The remainder is concentrated primarily in western Kazakhstan, Central Asia, and the southern Volga-Urals.

Condensate Production

Despite the presence of a sizable reserve base, the Soviets have been slow in bringing condensate production on line. Limited commercial production began during the middle 1950s near Baku in Azerbaijan. In the 1960s the North Caucasus areas of Stavropol' and Krasnodar became the principal Soviet condensate producers, responsible for well over 60 percent of the limited national output (figure 2). A major rise in Soviet production was not achieved until the 1970s, primarily due to the development of two giant gas condensate fields—the Vuktyl field in Komi ASSR, and the Orenburg field in the southern Urals. Vuktyl

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Figure 3
Soviet Union: Gas Condensate Production, 1970-90

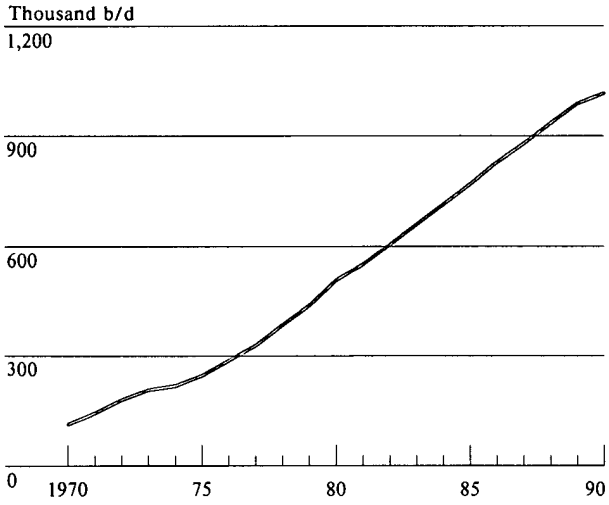

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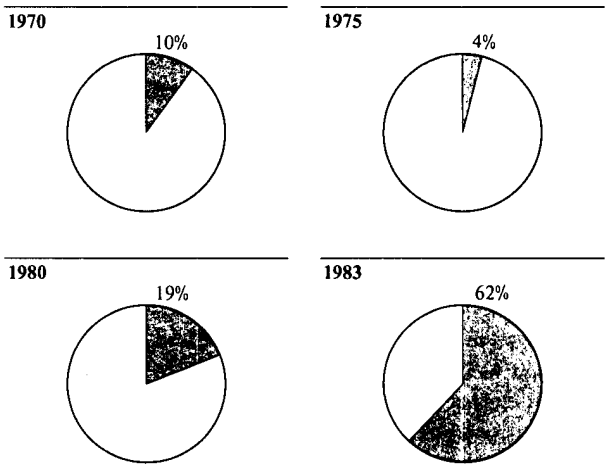
Figure 4
Soviet Union: Crude Oil and Gas Condensate Production Growth, 1970-83



© Condensate's share of oil production growth

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production began in 1969 and rose to over 120,000 b/d in 1973, gradually declining to its current output of about 55,000 b/d a year. At Orenburg the Soviets completed the first two stages of the USSR's largest gas processing complex during the 1974-75 period. The field produced over 45,000 b/d of condensate in 1975, and, after the third stage opened late in 1978, production continued to increase to its current level of about 85,000 b/d. Orenburg and Vuktyl together accounted for nearly two-thirds of all Soviet condensate production during the middle 1970s—over 150,000 b/d of a national condensate total of about 250,000 b/d in 1975 (figure 3).

Since the early 1970s, data on condensate production have been difficult to obtain. The Soviets began listing condensate under crude production and, after 1975, stopped providing detailed condensate figures on a national basis. Consequently, with the exception of a few "showcase" producers, only limited published data for individual fields and regions are available. Nevertheless, we have pieced together a production profile from these data

State Department sources and Soviet open literature report that total 1976 Soviet condensate production ranged between 275,000 b/d and 300,000 b/d. A steady rise in condensate production during the late 1970s is consonant with five-year plan data which indicate a production level between 490,000 b/d and 550,000 b/d for the period 1980-81. Given the increased production of condensate from the northern West Siberian gasfields, we estimate that production has now risen to about 660,000 b/d a year.

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Our analysis of production since 1975 suggests that condensate has played a significant role in the growth of Soviet crude oil output (figure 4). In the period 1976-83, condensate production more than doubled, adding some 385,000 to 410,000 b/d, while crude oil production grew about 2 million b/d—roughly 20 percent. Thus condensate provided 15 percent of the total growth in Soviet oil production over this period.

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Moreover, condensate's share of annual production increments is growing larger, making the performance of the condensate sector even more crucial to Soviet production goals. We estimate that condensate production in 1983 increased by at least 55,000 b/d, accounting for nearly two-thirds of the increase in Soviet crude and condensate output over the 1982 total. Later in this decade, we expect condensate to supply virtually all the net annual increases to Soviet oil production.

Problems of the Condensate Industry

Organizational, technological, and managerial problems have hampered Soviet efforts to raise condensate production to a level more in line with the size of the vast reserve base. The major institutional problem appears to be condensate's stepchild status in the Soviet energy sector. Condensate production and processing has always been a rootless, fragmented operation under the jurisdiction of several ministries, but assigned primarily to none. Since condensate is produced from both gas and oil fields, the Soviets cannot assign condensate a separate ministry; both the Ministry of Gas Industry (MGI) and Ministry of Petroleum Industry (MPI) prefer to concentrate on fulfilling their primary objectives of extracting dry gas and crude oil. Because of this split, neither organization feels fully responsible for the planning or management of condensate development and production.

Condensate production is further hampered by a shortage of the necessary processing equipment and technology. A high percentage of the oil well gas recovered at oilfields has been flared rather than processed to recover condensate components. In the early 1970s, less than 60 percent of available condensate was processed because of equipment shortages, and open Soviet sources indicate that this figure has risen to only about 75 percent in the 1980s. A similar situation exists in the natural gasfields, where equipment shortages often adversely affect condensate recovery. Few national figures are available on such lost condensate, but in 1970, for example, condensate production potential was estimated by Soviet economists to have been over 270,000 b/d compared with the 115,000 b/d actually produced.

Even where the necessary equipment is available, many oil and gas field managers, driven by oil or gas production quotas, are still not efficiently extracting condensate. In gasfields, much condensate is lost during the gas production process when the Soviets let formation pressures drop so low that condensation takes place within the reservoir and the condensate is lost. This occurrence can be avoided by "cycling," a technique used for many years in the United States in which processed dry gas is recycled back into the reservoir to maintain formation pressure and is produced only after most of the condensate has been recovered. Despite numerous recommendations in the Soviet press during past years that the "cycling" technique should be adopted, Soviet field managers have only just started to use this approach on an experimental basis at Novotroitskoye in the eastern Ukraine. Ironically, this "cycling" technique has been touted by the Soviets as a "revolutionary new approach" to condensate recovery despite its having been mentioned in Soviet petroleum journals since the early 1970s.

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Outlook for Condensate Production

Because of the prospects of declining crude oil production, Soviet planners believe that the condensate industry must provide a prolonged period of substantially increasing production if overall oil production goals are to be met. Ambitious production goals for the 1980s have been proposed although no specific details have been announced. Our analysis, based on Soviet open-source data

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that the Soviets hope for net additions to condensate increments on the order of some 80,000 to 110,000 b/d per year over the rest of this decade, nearly doubling current production efforts by 1990.

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Despite the problems confronting the condensate industry, we believe the Soviets are still likely to boost production substantially. By simply devoting more time and attention to efficient extraction and processing procedures, rapid progress is being made in the middle Ob' oilfields. The condensate industry will also

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Urengoy: A Troubled Supergiant

Soviet organizational, technological, and managerial problems affect condensate output at virtually every field in the country. But nowhere are these problems more painfully evident than at Urengoy—considered to be the largest gas deposit in the world and the highest priority energy development project in the country. Urengoy has almost unlimited dry gas reserves and large amounts of condensate. It is slated to supply some 40 percent of Soviet national gas production and about 13 percent of condensate production by 1985, with natural gas being the primary fuel source for the gas export pipeline currently under construction. Yet, Urengoy's development has been delayed considerably by Soviet blundering.

The slow progress at Urengoy can be traced to the lack of a truly authoritative central office with complete decisionmaking authority, resulting in continuous organizational struggles for power and jurisdiction over various parts of the Urengoy "pie." The various ministries have been unable to agree on a comprehensive well-coordinated field development plan. The MGI, nominally in charge of the Urengoy project, cannot command needed cooperation from other ministries responsible for vital supplies and services. Consequently, the late arrival of critically needed equipment, spare parts, and skilled labor, as well as support infrastructure, such as electric power, roads, and housing are bottlenecks to both dry gas and condensate development.

Urengoy has also suffered from poor management of the condensate effort, both in Moscow and in the field. Planners have taken several years to decide whether to locate small processing plants at the field, build larger ones farther south in the middle Ob' region, or pipe it to more distant processing centers in Tomsk and the Urals-Volga region. Open sources in late 1983 indicated that local plants will process the condensate and that one plant was already under construction. Aware of the indecision in Moscow, production officials at Urengoy have chosen to postpone development of the more complex condensate reservoirs.

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Little has been reported in the press on technology problems, but the Soviets are clearly worried that their condensate drilling and processing technology is not up to the task at Urengoy. Equipment capable of handling the high pressures and depth of the condensate reservoirs as well as the extreme climate and permafrost is not sufficiently available, slowing drilling progress considerably. In addition, the Soviets continue to have difficulties developing the complex equipment—compressor and cooling installations, heat exchangers, and separators—needed to process Urengoy's condensate.

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Urengoy, proudly hailed by the Soviets as the world's largest gasfield, should be a showpiece of the nation's energy sector. As the litany of problems enumerated above indicates, it is instead dangerously close to becoming a symbol of Soviet ineptness, particularly in condensate production. Though scheduled to produce about 110,000 b/d of condensate by 1985, Urengoy, in our estimation, will be fortunate to produce as much as 50,000 b/d.

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reap the benefits of spinoff production returns from high-priority projects such as Orenburg and Urengoy that are aimed at the extraction of oil, gas, sulfur, and other chemical products. In addition, condensate production will begin flowing from a number of new and relatively accessible fields in the western part of the country as well as several large oil and gas fields in West Siberia.[2] Our analysis indicates that these positive developments could result in an estimated new condensate production of 80,000 to 110,000 b/d a year over the rest of this decade.

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[2] See the appendix for a more complete description.

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Reaching the Soviet goals of net additions of 80,000 to 110,000 b/d of condensate, however, will require fundamental organizational and managerial reforms in the energy sector and large increases in condensate investment that, in our judgment, will be unattainable. The Soviet bureaucracy places a premium on consensus and avoidance of risk, ensuring a conservative approach to solving organizational problems. General Secretary Andropov publicized the need for reorganization of the energy ministries but accomplished little before his death. His conservative successor, Chernenko, is even less likely to promote innovative organizational change. The ongoing investment squeeze in the economy, caused by slow economic growth and the escalating investment requirements of other energy efforts, is likely to continue to restrict the flow of money into the condensate industry. Moscow simply cannot afford to take large amounts of scarce investment funds away from the middle Ob' oil region, the West Siberian gasfields, or the gas trunk pipeline effort and divert them to condensate extraction and processing. Another negative factor will be the continuing inability of the Soviets to provide skillful management of a number of the aging fields that have been the mainstays of condensate production over the past decade.

The Soviets have been noticeably silent about plans for maintaining or augmenting production from older fields. The Soviets have stated that expanded production may be possible from deeper horizons recently discovered at Vuktyl; however, no specific figures or plans have been announced. Neither have specific plans been announced for Orenburg, where production could be sustained or even increased if additional gas processing capacity were added. We believe the condensate production from these fields—strongly linked to oil and gas output—is likely to drop by 25,000 to 55,000 b/d per year given the poor Soviet oilfield management record and the apparent lack of detailed programs designed to sustain production through the 1980s.

Without a major increase in effort, production declines at these older fields will probably limit annual condensate production increases to an average 50,000 to 60,000 b/d. These annual increments should increase condensate output from its current level to about 800,000 b/d by 1985 and about 1.0-1.1 million b/d by 1990 (figure 4). Soviet performance at the older oil, gas, and condensate fields will determine whether or not output reaches the high or low end of our estimate.

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Implications for Moscow and the West

Although below Soviet aspirations, this projected level of production coupled with the sizable reserve base ensures for condensate a position of rising prominence in the Soviet energy picture. If overall crude-condensate production drops—as we believe it will—to between 11 million b/d and 12 million b/d by 1990, condensate's share of this total could approach 10 percent, making the condensate sector as important as major oil-producing regions such as Komi ASSR or Kazakhstan. Condensate's rising production will go a long way toward keeping a possible future Soviet oil supply shortfall within manageable proportions.

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Increased condensate production will also assist the Soviets in supplying oil to Eastern Europe and maintaining vital hard currency income from the world market. Oil is now the largest single source of Soviet foreign exchange and provides Moscow with a greater hard currency return than all other export items put together. Rising condensate production will supply the Soviets with more valuable light refinery products such as diesel, gasoline, and aviation fuel, which are in greater demand on the world market than the current heavier Soviet refinery product mix. The Soviets are currently shipping these lighter petroleum products in considerable quantities to important non-Communist world countries such as Japan, India, and Italy.

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Increased condensate production will also have important consequences for Soviet industry. Soviet petroleum refineries currently do not possess the cracking capacity needed to meet the economy's demand for light products. This problem will worsen during the decade as the Soviet crude oil mix becomes heavier while the demand for highly refined products grows. Increased production of condensate and the light products derived from it will help reduce potential

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shortages of such critical fuels as gasoline, kerosene, and diesel as well as provide sorely needed inputs of feedstocks for the petrochemical industry. 25X1

To successfully implement future condensate production and processing projects, however, the USSR must substantially increase its purchases of Western equipment and technology. As is the case throughout its oil industry, Soviet condensate technology is about 10 to 20 years behind that of the United States, creating a substantial dependence on Western designs and equipment for recovering and processing condensate. Several of the most important future condensate producing fields, such as Astrakhan' and Tengiz, have extremely high levels of dangerous sulfur and carbon dioxide. Successful exploitation of these fields will require expensive and complex extraction and processing equipment that Soviet industry is currently unable to manufacture. 25X1

This technological dependency will also become more acute as development efforts require deeper drilling at sites such as Urengoy or as more complex reservoir conditions are encountered at sites such as Karachaganak and in offshore areas such as the Caspian Sea. For the foreseeable future, the USSR will have to rely heavily on the West—particularly France, Japan, Italy, West Germany, and the United States—for much of the equipment and know-how to realize its condensate production potential. 25X1

Appendix

Key Soviet Condensate Fields

The Orenburg and Vuktyl fields will continue as the largest individual condensate producers over the short term. For the long-term production increase envisaged by Soviet planners, however, new fields must be developed. We expect increased development efforts at Urengoy in West Siberia, the Astrakhan' and Karachaganak areas of the southern Volga and western Kazakhstan, and several fields in Komi ASSR. Smaller fields in the Caspian, Ukraine, and North Caucasus areas are potential candidates for future development. The Soviets also plan significant improvements in condensate extraction from the giant middle Ob' oilfields.

Urengoy appears to have the most potential for increased condensate production. In addition to the enormous shallow deposits of dry gas, this supergiant field contains massive amounts of condensate that the Soviets expect to extract from deeper lower Cretaceous Valanginian structures. From an annual production total of 25 billion cubic meters (bcm) of gas, extraction of up to 110,000 b/d of condensate is expected annually by 1985, rising eventually to over 550,000 b/d by the 1990s. Development constraints have been examined by Soviet experts, and, according to one authority, up to 476 production wells producing approximately 20 bcm of gas are required to produce over 80,000 b/d of condensate annually from Urengoy. Almost 3,200 wells producing over 250 bcm of gas would be needed to extract about 550,000 b/d of condensate a year from the field. Urengoy is already facing serious production problems due to the lack of necessary drilling and processing equipment and continuing lags in the construction of on-site gas processing facilities necessary for treating the dry natural gas and extracting the condensate fractions. In spite of numerous infrastructure and organizational problems, the first condensate production well at Urengoy apparently started operation in mid-1982, and the 1983 condensate plan for Urengoy was set at over 10,000 b/d. We doubt the Soviets will be able to produce the sharp rise in gas output needed to achieve the 110,000-b/d condensate goal planned for 1985.

Another major gas condensate development area slated for startup in the mid-1980s is *Astrakhan',* a high-sulfur gas condensate field in the southern Volga discovered in 1976. This difficult-to-develop sour gas-field is scheduled for a late 1984 or early 1985 startup with early condensate production expected to range from 27,000 b/d to over 55,000 b/d annually. Present plans also call for the construction of a condensate and sulfur processing plant with an ultimate natural gas capacity of 18 bcm. The Astrakhan' field, however, poses several potentially severe developmental problems—deep producing horizons (4,200 meters), high reservoir pressures (630 atmospheres), and an unusually high percentage of hydrogen sulfide and carbon dioxide (each about 25 percent). The Soviets are attempting to overcome these problems with specialized equipment purchased from a number of Western countries. Negotiating delays, hard currency shortages, and operating conditions beyond Soviet technical capabilities probably will delay condensate production for several years beyond the scheduled date.

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Karachaganak, some 80 kilometers south of Orenburg in northwest Kazakhstan, may also become an important condensate producer. This field, which is regarded as a southwestern extension of the Orenburg field, is projected to produce over 55,000 b/d per year by 1985. Although no firm dates have been set, the Soviets also have high hopes for new production from several other rich condensate fields just north of Karachaganak in the southern Volga-Urals area such as *Nagumanskoye* and *Berdyanskoye* near Orenburg. The Soviets also intend to produce over 25,000 b/d of condensate per year by the late 1980s from the promising *Tengiz* oil and gas field in northwestern Kazakhstan near the Caspian Sea. Tengiz, like Astrakhan', contains extremely high percentages of sulfur and carbon dioxide—a potential drawback to meeting future production schedules.

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plans for constructing condensate pipelines from both Astrakhan' and Karachaganak [3] to the Orenburg gas processing complex and for the erection of a major condensate line from Urengoy to Surgut, Tobol'sk, and on to the Volga-Urals area. All these plans appear to be part of a major effort to upgrade the priority of condensate and petroleum products pipeline construction, traditionally lagging far behind gas and crude oil trunkline construction efforts. We believe this effort will be constrained by severe competition for resources with the rapidly expanding natural gas pipeline net during the rest of the decade.

Komi ASSR would achieve equal prominence with West Siberia in future condensate production. Some sources have stressed the need to more efficiently process associated gas from the large *Usa-Vozey* oilfields, and the Soviets have also expressed optimism about the prospects of future condensate production from deeper horizons at *Vuktyl*, as well as the recently opened *Zapadno-Soplyas* condensate field—hailed in the Soviet press as the eventual condensate replacement for Vuktyl. The prominence accorded this field is somewhat puzzling since it apparently contains only about one-tenth of the natural gas reserves of Vuktyl. If condensate reserves are roughly analogous, this field would not seem to be a promising replacement candidate. The Komi region has traditionally taken a backseat in the allocation of investment funds and equipment to the oil industry flagship West Siberia. The Soviets have been conspicuously silent as to precise development plans for the Komi condensate industry, an indication that condensate development will probably continue to lag.

Other promising candidates for future production appear to be the high-sulfur fields associated with the newly constructed *Mubarek* gas processing plant in Uzbekistan, the very promising giant *Sovetabad* gas condensate field in southeastern Turkmen SSR, Caspian offshore gas condensate fields such as *Bulla-More* and others, and possibly gasfields in the Ukraine such as *Novotroitskoye*, where the "revolutionary" cycling process is being tested. In spite of generally declining oil and gas production in these areas, the Soviets appear to be optimistic about NGL production possibilities judging from the Novotroitskoye experiment and the recent construction of a natural gas liquids refinery plant at Dolina in the western Ukraine. Output totals from these areas are not expected to be large enough to significantly affect national condensate production.

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The Soviets also have high hopes for condensate extraction increases from the large oilfields in the middle Ob' region of West Siberia. They plan to significantly raise the percentage of utilization of byproduct petroleum (casing head) gas from about 75 percent in 1983 to over 85 percent by the end of 1985, with a resulting rise in condensate production to over 190,000 b/d.

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[3] Several unofficial open-source Soviet reports indicate that the Karachaganak-Orenburg pipeline was completed in late 1983.

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Figure 5
Soviet Gas Condensate Industry

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