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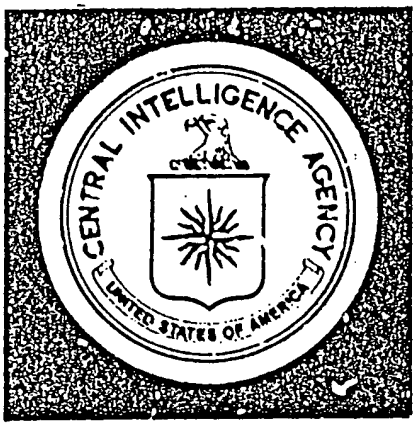

Intelligence Memorandum

The Impending Soviet Oil Crisis

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ER 77-10147
March 1977

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SECRET

The Impending Soviet Oil Crisis

The Soviet oil industry is in trouble. Soviet oil production will soon peak, possibly as early as next year and certainly not later than the early 1980s. The maximum level of output reached is likely to be between 11 and 12 million barrels per day (b/d)–up from the 1976 level of 10.4 million b/d. Maximum levels are not likely to be maintained for long, however, and the decline, when it comes, will be sharp.

The Soviets have two basic problems: one of reserves and one of production. Barring an extremely unlikely discovery of a massive new field close to an existing field, new deposits will not be found rapidly enough to maintain acceptable reserves-to-production ratios, and those fields that account for the bulk of Soviet production are experiencing severe water encroachment. As a result, increasingly large quantities of water must be lifted for each barrel of oil produced, and high-capacity submersible pumps–obtainable only from the United States–will be required if production declines are to be staved off even temporarily.

During the next decade, the USSR may well find itself not only unable to supply oil to Eastern Europe and the West on the present scale, but also having to compete for OPEC oil for its own use. This would be a marked change from the current situation, in which exports of oil to the West annually provide 40 percent of total Soviet hard currency earnings. The USSR has large reserves of coal and natural gas, but those scheduled for exploitation over the next decade are east of the Urals, far from consuming centers in the western USSR. Distance, climate, and terrain will make exploitation and transport difficult and expensive. Exports of gas will increase, but will not compensate for the loss of earnings from the export of oil. Although some substitution of coal and gas for oil in domestic use will be possible in the long run, the effect of such substitution will be minimal

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Note: Comments and queries regarding this memorandum are welcome. They may be directed to

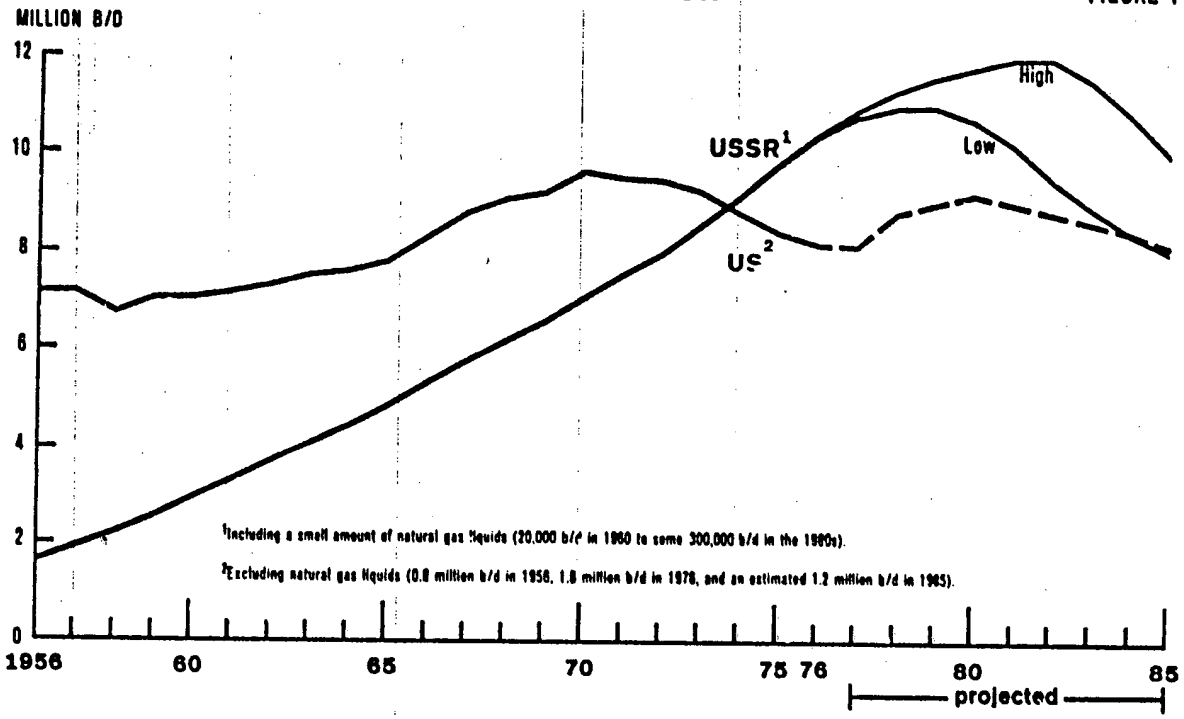
the Office of Economic Research

in the short run. Neither hydroelectric power transmitted from the east nor construction of nuclear electric plants (mainly in the western USSR) can be expected to afford much relief in the Soviet energy situation for more than a decade.

The Problem

1. Unlike the United States, which has long restricted production for reasons of conservation and profit, the USSR favors a forced draft approach. Short-term production goals are considered floors, not ceilings, and rewards are given for exceeding them with little regard to productivity over the longer term. Under these conditions, Soviet production has expanded much more rapidly in the last 20 years than that of the United States.

Soviet and US Crude Oil Production FIGURE 1



2. The Soviet stakhanovite approach has led to (a) an emphasis on development drilling over exploration, with the result that new discoveries are failing to keep pace with output growth; (b) overproduction of existing wells and fields through rapid water injection and other methods, with the result that less of the oil in place is ultimately recovered; and (c) new capacity requirements that soon will run far beyond the Soviet oil industry's capability. Efforts to further increase production–such as are demanded by the goals of the recently announced 5-year plan–can only worsen the situation and make the eventual downward slide more rapid.

USSR: Production of Crude Oil,[1] by Region

Million Barrels per Day

				CIA Estimates of Peak Output	
	1970	1975	1980 Goal	High	Low
Total	7.06	9.82	12.80	11.8	11.0
Western region and Urals	5.80	6.00	5.71	5.6	4.9
Urals-Volga	4.17	4.50	NA	4.1	3.5
Tartar	2.01	2.07			1.5
Bashkir	0.81	0.81	2.85	2.9	0.6
Kuybyshev	0.70	0.69			0.5
Perm'	0.32	0.45	0.62	0.6	0.5
Orenburg	0.15	0.24			
Lower Volga	0.14	0.14		0.6	0.4
Udmurt	0.01	0.07			
Saratov	0.03	0.03			
Belorussia	0.08	0.16	1.74	0.2	
Caucasus	0.69	0.47		0.3	
Azerbaydzhan	0.41	0.35		0.4	1.0
Ukraine	0.27	0.23		0.2	
Other	0.03	0.07		Negl	
Komi and Arkhangel'sk	0.15	0.22	0.50	0.4	0.4
Eastern region	1.26	3.82	7.09	6.2	6.1
West Siberia	0.63	2.96	6.16	5.2	5.2
Central Asia	0.58	0.82	NA	0.9	0.8
Mangyshlak	0.21	0.40	0.54		
Emba	0.05	0.08			
Turkmen	0.29	0.31	0.28		
Other	0.03	0.03			
Sakhalin	0.05	0.04	0.11	0.1	0.1
Other	Negl	Negl			

1. Including gas condensate.

3. As the ratio of reserves to output has fallen, the bulk of Soviet output has come increasingly from fields approaching exhaustion. The result has been an acceleration of drilling requirements, which will level off or decline only when–and if–very large new additions are made to the producing reserve base. The Soviets speak of this problem in terms of the depletion offset–the amount of new capacity required to offset depletion of old capacity in each 5-year plan period.

4. During the 1961-65 plan period, only 1.3 million b/d (67 million tons per year) of capacity had to be replaced. In 1971-75, 5.1 million b/d (254 million tons per year) of replacement capacity was required because of rapid depletion. Viewed in another way, about 72 percent of 1970 capacity had to be replaced by the end of 1975. The target for the 1976-80 plan is 10.6-10.8 million b/d (530-540 million tons per year) of new capacity; 7.8 million b/d—equal to about 80 percent of the capacity on line in 1975—is to offset depletion. If depletion is more rapid than the Soviets expect—and, based on their past record, it may well be—considerably more of the 1975 capacity will have to be replaced.

Reserves

5. There is uncertainty about the size of the USSR's reserves, because of definitional problems as well as Soviet secrecy. Our best estimate is that Soviet proved reserves are 30-35 billion barrels, roughly comparable with those of the United States. There is no doubt that Russian proved reserves have been falling in recent years, and there is very little chance that enough new oil will be discovered during the next few years to appreciably improve the reserves-to-production ratio. Indeed, despite major efforts it will probably deteriorate further.

6. Although the USSR has abundant potential reserves in Arctic, East Siberian, and offshore areas, development of such reserves is at least a decade away. Thus, during the next 8-10 years, almost all Soviet output will have to come from existing fields and from new fields in existing producing regions.

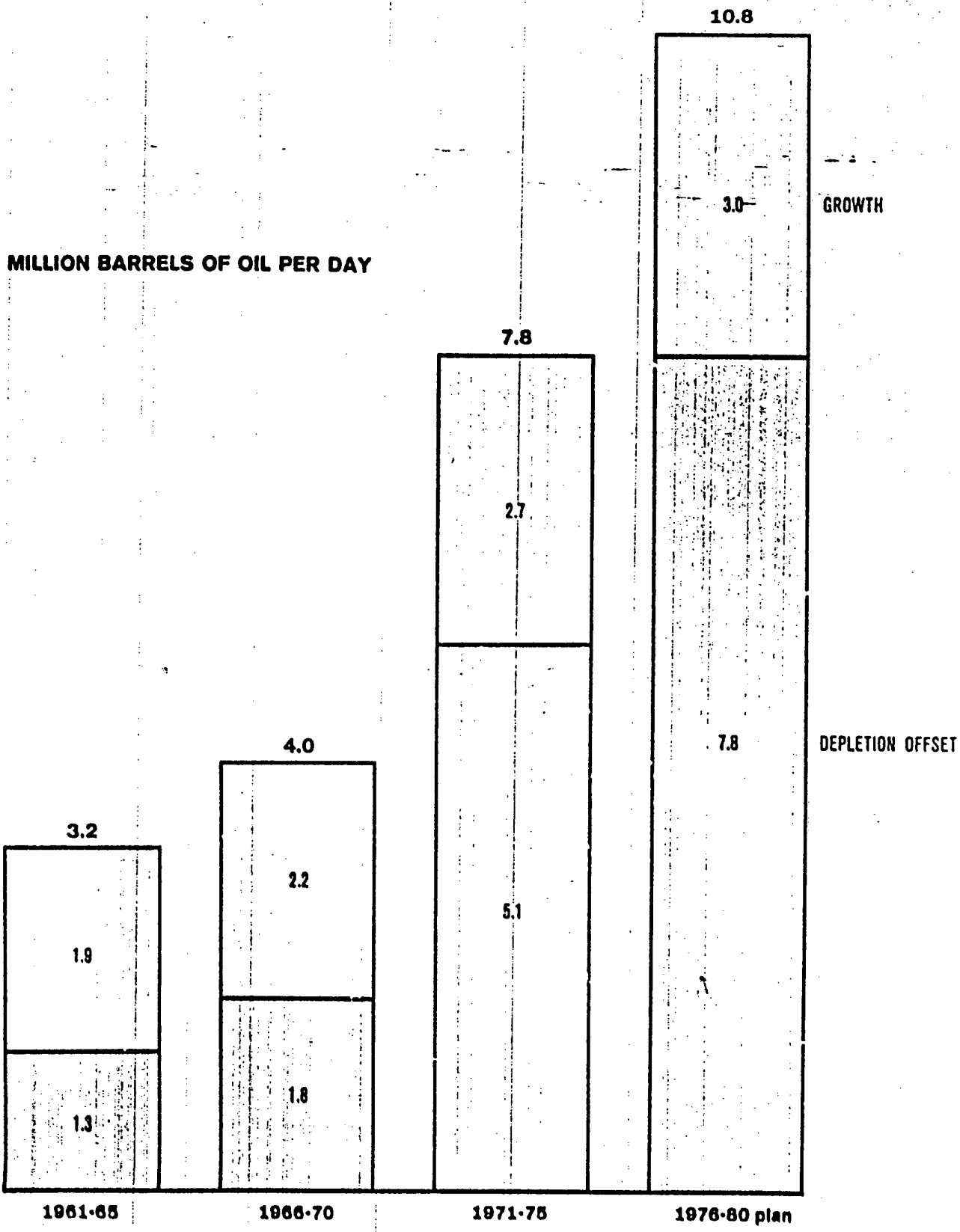
The Outlook for Output from Existing Production Regions

7. From World War II through 1970, the growth in Soviet oil output came either from the Caspian fields or, after the mid-1950s, from large fields in the Urals-Volga region. Since 1970, nearly all output growth has come from West Siberia, primarily from the giant Samotlor field. Current Soviet plans call for holding aggregate output nearly constant west of the Urals, while doubling production in West Siberia. Because of a variety of problems, we believe that output west of the Urals will decline, while that of West Siberia will fall far short of doubling.

8. Production from fields in the western part of the country is coming increasingly from greater depths and from in-fill drilling which allows more intensive exploitation of already tapped reservoirs. All growth in output through 1980 will

USSR: Additions to Oil Producing Capacity

FIGURE 2



come from West Siberia, where the inhospitable climate, difficult terrain, and vast distances greatly complicate operations. In 1976, approximately 60 percent of West Siberian output and roughly one-fifth of national production came from the giant Samotlor field on the middle Ob'. Soviet sources indicate that this field will reach peak production in the next year or so and will hold peak levels for no more than 4 years. It is already experiencing rapid water incursion. The water cut reached 47 percent in 1975, and increasing quantities of fluid (water plus oil) must be lifted to recover any given quantity of oil. Although new fields are being discovered in West Siberia, no giant fields comparable to Samotlor have been found.

The Drilling Problem

9. The USSR does not have the drilling capability to pursue adequate development and exploration programs simultaneously. The Soviets have some 1,600 active rigs, about the same as the United States. In terms of meters drilled, however, the Soviet effort amounts to only about one-fifth that of the United States. In 1971-75, the Soviet Ministry of the Oil Industry drilled a total of about 52 million meters. In 1975 alone, the United States drilled 53 million meters with about 1,700 rigs. We estimate that, even with a maximum effort, the Soviets will not be able to come close to drilling by 1980 the 75 million meters called for by their current 5-year plan.

10. The poor Soviet drilling record is in part the result of the fact that 80 percent of their drilling is done with turbodrilling rigs that are highly inefficient for deep drilling or for use in soft formations. Greater access to advanced Western technology and rotary drilling equipment could help alleviate the Soviet drilling problem.

The Fluid Lifting Problem

11. In the 1950s, when wells in the Urals-Volga region began to stop flowing naturally, the Soviets were forced to begin pumping. At that time, however, pumping equipment was in short supply. To forestall a slowdown in the growth of oil output, the Soviets adopted the practice of massive water injection within and along the edges of each field. If enough water is forced into a formation, it raises reservoir pressures so that wells once again flow without pumping. The Soviet system differs from the standard Western secondary recovery technique of

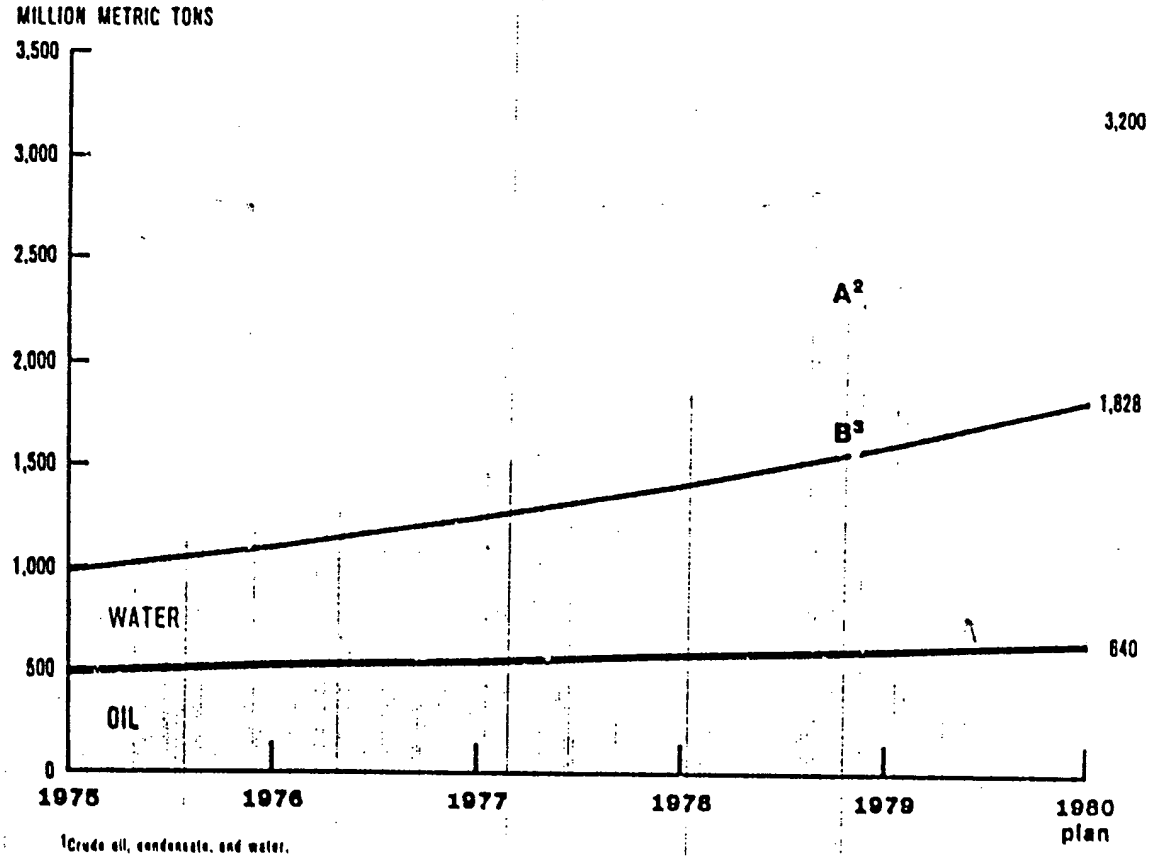
waterflooding in that the object is to increase rather than just to maintain pressure. Much more water is injected than oil produced.

12. Although massive water injection can boost production for a time, eventually the water will find a channel of least resistance and break through to the oil-producing well, a process that leaves behind much oil in the less permeable portions of the formation. When the wells begin to show water in large quantities, the natural flow will usually stop and the wells must be pumped. In this case, however, conventional pumping equipment cannot be used; special high-capacity submersible pumps are needed because much greater volumes of fluid (water plus oil) must be lifted.

13. Such pumps began to be used extensively in the USSR in the late 1960s. In 1973, these pumps provided 2.5 million b/d of the Soviet total of 8.6 million

USSR: Fluid Lifting Requirements[1]

FIGURE 3



[1]Crude oil, condensate, and water.

[2]Water which constituted 50 percent of liftings in 1975 will rise to 60 percent in 1980.

[3]Water which constituted 50 percent of liftings in 1975 will rise to 65 percent in 1980.

b/d. The Soviets had some 12,000 of these pumps in 1975, and their need for such equipment is increasing rapidly as water encroachment becomes a problem in more and more fields. Although some West European nations and the USSR itself manufacture a lower capacity version of these pumps, the Soviets recognize that the only pumps adequate to deal with their lifting problem are made in the United States. The 1,000 pumps already purchased from the United States have a higher total lifting capacity than the 11,000 pumps of domestic origin. Even in the United States, such pumps are manufactured by only two companies and are in short supply. As an alternative to high-capacity submersible pumps, at least in some fields, the Soviets are considering wider use of gas-lift equipment. The kind of projects they have in mind would require large-scale imports of US technology and long lead times.

The Longer Term Outlook

14. The initial falloff, when it comes, will almost certainly be sharp; thereafter output may continue to fall sharply, level off, or perhaps even increase as new fields are brought into production in frontier areas. There is no question that new fields--some quite large--will eventually be discovered. Given the rapid rate of depletion of existing fields and the technical difficulties associated with exploration and exploitation in frontier areas, however, we doubt that the new discoveries will come on stream rapidly enough to do more than temporarily arrest the rapid slide of Soviet output.

15. As we stated earlier, only small amounts of Soviet production during the next decade will come from outside existing producing areas. In the early 1980s new offshore Caspian reserves may make some small contribution to output, as will new discoveries on the Mangyshlak Peninsula on the east shore of the Caspian and in the Pechora region west of the Urals. The Soviets also hope to find oil in deep structures in the northern part of West Siberia's Tyumen' Oblast. Limited exploration in this region, however, has so far yielded mainly natural gas and condensate.

16. Geological conditions favorable to large future discoveries exist over much of the Arctic offshore regions (especially in the Barents and Kara Seas), in the East Siberian lowlands, in deep structures in the Caspian area, and perhaps off Kamchatka and Sakhlin in the Sea of Okhotsk. Production from most of these areas, however, is at least a decade away. In the offshore Arctic, environmental

conditions are much more severe than in the North Sea; technology for exploration and production in this region does not yet exist, even in the West. Although conditions are more favorable near Sakhalin and in the East Siberian lowlands, production and transportation difficulties make it doubtful that significant production could take place until 10 years after a major discovery--which has yet to be made. The lead time would be shorter for production from deep wells in the Caspian region; the USSR, however, lacks the equipment and experience necessary to undertake a deep drilling program without extensive Western help.

Economic Implications

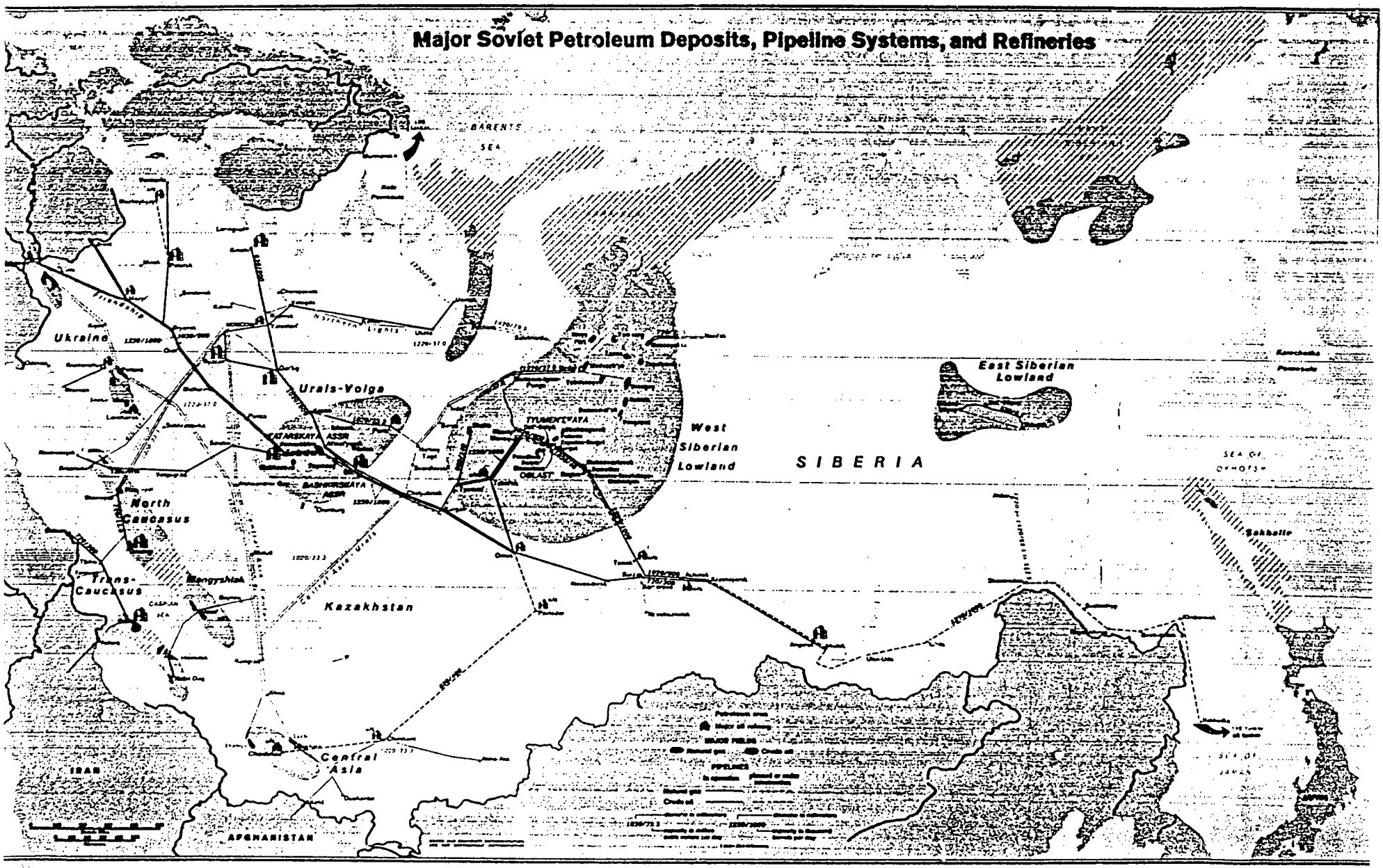
17. When oil production stops growing, and perhaps even before, profound repercussions will be felt on the domestic economy of the USSR and on its international economic relations. The extent of such repercussions can be only guessed at without further research. At a minimum, the USSR will find it extremely difficult to continue to simultaneously meet its own requirements and those of Eastern Europe while exporting to non-Communist countries on the present scale. More pessimistically, the USSR will itself become an oil importer.

18. These are important considerations for the Soviet Union. It now supplies three-fourths of the oil required by the Communist countries of Eastern Europe, and it undoubtedly wishes to retain the political and economic leverage that goes with being their principal supplier. For many years the export of oil to non-Communist countries, mainly in Western Europe, has been the USSR's largest single source of hard currency.

19. In the long run, considerable substitution for oil will be possible domestically and perhaps in export markets as well. The USSR has large reserves of coal and natural gas. Development of these reserves will take time and large capital investments. The cost of Soviet energy almost certainly will increase. The largest known gas reserves are in permafrost zones of Siberia where production and transportation will be difficult. Deposits of coal scheduled for exploitation in the next decade are also east of the Urals; considerable investment in transport facilities and on-site thermal powerplants and other coal-using industrial facilities will be required.

20. Electric power from hydroelectric and nuclear powerplants will make only a small contribution for many years to come. Although there are vast hydroelectric resources in Eastern regions of the USSR, the technical problems of long-distance

transmission must be solved before such resources can be fully exploited. The Soviets consider nuclear power to be the best source of new electric power in European areas. A program for constructing nuclear powerplants is under way, but it will be quite some time before these plants can have an important effect on the power base. In 1975 nuclear power represented 2 percent of total power production, and it will reach only about 6 percent in 1980.


Major Soviet Petroleum Deposits, Pipeline Systems, and Refineries
BARENTS SEA
Ukraine
Urals-Volga
East Siberian Lowland
West Siberian Lowland
SIBERIA
North Caucasus
Trans-Caucasus
Kazakhstan
Central Asia
IRAN
AFGHANISTAN
Sakhalin