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ENERGY IN SOVIET POLICY

A STUDY

PREPARED FOR THE USE OF THE

SUBCOMMITTEE ON INTERNATIONAL TRADE, FINANCE, AND SECURITY ECONOMICS

OF THE

JOINT ECONOMIC COMMITTEE CONGRESS OF THE UNITED STATES

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LETTERS OF TRANSMITTAL

APRIL 1, 1981.

To the Members of the Joint Economic Committee:

Transmitted herewith for the use of the Joint Economic Committee, the Congress, and the interested public is a study entitled "Energy in Soviet Policy." This study provides an overview of Soviet energy prospects in the decade ahead and explores the political and economic implications of possible changes in Soviet energy production.

We wish to thank the Congressional Research Service of the Library of Congress for making available the services of John P. Hardt, Senior Specialist in Soviet Economics and Associate Director for Senior Specialists of the Congressional Research Service. Dr. Hardt organized and edited the study and also contributed to it. Individual papers were written by a number of different scholars from research organizations and the Federal Government. The project was supervised for the committee by Kent H. Hughes.

The views expressed in the study are those of the individual authors and do not necessarily represent the views of the Joint Economic Committee or of its individual members.

Sincerely,

HENRY S. REUSS,
Chairman, Joint Economic Committee.

MARCH 24, 1981.

Hon. HENRY S. REUSS,
Chairman, Joint Economic Committee, Congress of the United States, Washington, D.C.

DEAR MR. CHAIRMAN: Transmitted herewith is a study entitled "Energy in Soviet Policy." This study was edited and coordinated by Dr. John Hardt, Senior Specialist in Soviet Economics and Associate Director for Senior Specialists.

The study takes a hard look at the differing estimates of future Soviet oil production. The CIA is generally viewed as having the most pessimistic assessment of the Soviet energy outlook. According to recently revised CIA estimates, the Soviet Union faces a gradual decline in oil production to around 10-11 million barrels a day in 1985 and some 8 million barrels a day by 1990. If the CIA is correct, the Soviet bloc countries may become net energy importers sometime later in this decade. The added pressure on world oil prices could then add to our own inflationary problems. In addition, reduced Soviet energy production might loosen its hold on Eastern Europe and heighten its interest in Middle Eastern supplies.

At the optimistic extreme, the Economic Commission of Europe foresees steady or possibly somewhat increased Soviet oil production

throughout the 1980's. If the Commission is correct, the United States will be presented with quite a different set of challenges and opportunities. On the one hand, the Soviets would not add to existing demand on the world market for petroleum. On the other hand, an exportable surplus of oil and gas could become a powerful diplomatic tool in the hands of the Soviet Union.

Dr. John Hardt and his colleagues have rendered us a considerable service by exploring the differences among the various assessments of the Soviet energy future. Even more important, they have helped point out the quite different problems and opportunities that will confront the United States depending on whether Soviet energy ouput rises or falls. I also wish to express my thanks to Dr. Kent Hughes of the committee staff who supervised the Soviet energy project for the committee and to Ms. Helen Mohrmann of the committee staff who helped review a number of the individual papers.

It should be understood that the views expressed in this study are those of the individual authors and do not necessarily represent the views of the members of the subcommittee or the committee staff.

Sincerely,

GILLIS W. LONG,
Chairman, Subcommittee on International Trade, Finance, and Security Economics.

FEBRUARY 19, 1981.

Hon. GILLIS W. LONG,
Chairman, Subcommittee on International Trade, Finance, and Security Economics, Joint Economic Committee, Congress of the United States, Washington, D.C.

DEAR MR. CHAIRMAN: Enclosed is the study you requested, "Energy in Soviet Policy." This study is coordinated by John P. Hardt, Senior Specialist in Soviet Economics and Associate Director for Senior Specialists. Mr. Jonathan P. Stern is with Conant & Associates in their London office. Ronda Bresnick was in our office of Senior Specialists when she wrote her sections, but now is with the Office of East-West Economic Policy at the Department of Treasury. David E. Gushee is chief of the Environmental and Natural Resources Division. Joseph Riva is in Science Policy Research Division. David H. Root and Lawrence J. Drew are Senior Analysts at the U.S. Geological Survey. Dr. Leslie Dienes is Assistant Professor of Geography at the University of Kansas.

We appreciated the excellent internal reviews by James Robinson, Alfred Reifman, John Schanz, George Holliday and Clyde Mark of CRS. Dr. Ronnie Goldberg of the Office of Technology Assessment provided a useful critique.

Sincerely,

GILBERT GUDE,
Director, Congressional Research Service, Library of Congress.

CONTENTS

EXECUTIVE SUMMARY AND POLICY IMPLICATIONS

Energy output in the 1980s may present economic and policy problems for the Soviet Union. Responsible forecasts of future Soviet production capabilities support two very different scenarios: The Soviet Union might remain an important exporter of energy to Western Europe and elsewhere, or it might feel compelled to purchase large amounts of petroleum in the world market. The papers in this compendium explain the reasons for the uncertainty surrounding the energy forecasts and the implications of different output levels for Soviet and U.S. policies toward Western and Eastern Europe and the Middle East.

The breadth of the range of forecasts is a result of different estimates of the wealth of oil fields and production capabilities. The lack of hard data from Soviet sources makes evaluation of the differences very difficult. A series of controversial CIA reports predicted that Soviet oil production would peak soon, decline sharply, and that the USSR would cease to export oil by 1985. Although the CIA still predicts a fall in Soviet oil output, the precipitous fall has been forecast for 1990 instead of 1985 and the timing and level of imports has been revised downward. The CIA reports have been met with skepticism in the United States and are irreconcilable with European estimates. Analysis of discussions by Soviet officials at all levels indicates that there is a great deal of uncertainty about capabilities even among Soviet experts.

The level of Soviet energy production has very important implications for the United States and the rest of the world. A continued Soviet energy surplus would allow the Soviets to grow more rapidly at home while maintaining their close economic ties with their East European allies. Energy diplomacy would continue to be an effective tool to spread Soviet influence and counter Western initiatives. The Soviet Union currently derives about half of its hard currency earnings from exports of oil and natural gas. Without an energy export capability, the Soviets would be hard pressed to find a substitute source of the funds it uses to buy grain and Western technology.

The emergence of a Soviet energy deficit could affect developments ranging from the world price of oil to political stability in Eastern Europe. The Soviets might be forced into the world market and like any other source of additional demand, the Soviet presence would contribute to the escalation of oil prices. Falling energy output would also make it much more difficult for the Soviet Union to meet domestic growth targets or maintain commitments to Eastern Europe. A Soviet Union faced with the prospects of an energy deficit could react in a number of different ways. Controls and belts could be tightened at home or the Soviets could try to assure their access to Middle East oil. They might accept declining influence in Eastern Europe or seek other ways to maintain their existing political ties.

The Soviets do have options they could pursue now that might alleviate future energy problems. First, they could adopt an aggressive policy of maximizing current output at the expense of future oil production. Second, they could attempt to offset declining oil output by turning to other energy resources, particularly natural gas, coal, nuclear, and hydro-electric power. Finally, the Soviets could make energy a top priority and give it the kind of high level party support that only the military receives now.

To some extent, all of the Soviet options involve the use of Western technology. In fact, the availability of advanced energy equipment and technology is still a limiting factor in Soviet energy development. Most of their needs, however, can be served by Western supplies other than the United States. Moreover, especially in the short run, Soviet policy decisions and their physical resources will be the major factors determining the level of output. Thus a policy of energy equipment denial by the United States alone is likely to have limited impact on the Soviet energy sector as well as on Soviet domestic and foreign policy.

The analyses contained in this study point to a wide range of conclusions about the Soviet energy future:

If the CIA estimate is correct, Soviet oil production will fall to 10.5 mbd by 1985 and 8 mbd by 1990 and the CMEA countries (the Soviet Union and Eastern Europe) may become modest importers of petroleum. If the estimate of the European Commission is correct, Soviet oil production will stay constant or possibly grow to 14 mbd by 1990, and the USSR may be able to use its exportable oil surplus as an important economic lever.

A leveling off followed by a sharp fall in output by 1985 is more a possibility than a likelihood in our assessment.

Policy options are open to the USSR to sustain production levels, and there are a range of outcomes in future years, even prior to 1985.

A Soviet turnaround in energy trade, as originally suggested by the CIA, from substantial hard currency surplus earnings of more than $10 billion a year to a deficit of more than $20 billion is extremely unlikely, if not impossible.

If the Soviets are able to continue to expand natural gas exports, they will have an especially important diplomatic tool. If shortages of energy force withdrawal from energy trade with West Europe, considerable economic and diplomatic opportunities will be lost by the USSR.

It seems clear that the Soviets desire Western, especially U.S. technology for energy exploration and extraction, but the conclusion that they are uniquely dependent upon the United States for energy equipment is subject to serious question. Natural gas output increases—the key to Soviet energy policy success—turn on West European technology imports and credit.

I. OVERVIEW

By John P. Hardt*

General Prospects

If the "worst case" projection of Soviet energy supply occurs—Soviet oil production falls to 10–11 and 8 million barrels per day (MBD) by 1985 and 1990, respectively—the Soviet Union and the East European nations [CMEA] may together be modest net importers of petroleum in the near future.

If the "best case" occurs—a continued increase during the 1980's to 14 MBD—then the USSR may have an increasingly significant economic lever for use in diplomacy.

Soviet oil output growth may slow down, level off, or moderately fall but a sharp fall from over 12 million barrels per day to 8 (the CIA estimate) in the next decade, although possible, in our judgment, seems to be an unduly pessimistic projection for 1990. Soviet plans for 1985, released in December 1980, call for slight increases from 1981 to 1985. The Economic Commission for Europe (ECE) estimates Soviet oil production staying constant or increasing through the 1980's to as high as 14 MBD.

The CIA estimates reflect official U.S. intelligence views, the ECE estimates are based on international, including Soviet contributions to that commission of the United Nations. Soviet official plans fall somewhere in this range of views.

The smaller nations of Eastern Europe plan to be modest net importers from OPEC sources while maintaining the current level of about 1.6 million barrels of oil per day imports from USSR. The USSR needs Middle East oil and gas but is not likely to become a significant net oil and gas importer. A shift from net exporter by the U.S.S.R. in 1980 to net importer in the 1980s is unlikely. Only in the "worst" case do the Soviet Union and Eastern Europe have a significantly increased net demand effect on the world energy market by 1990.

The Soviet/East European energy policies are a major factor in their overall domestic and foreign policies.

Energy, especially increased consumption of oil and gas, will continue to be closely linked to Soviet economic growth. Short term effects of conservation and changes in structure of demand have limited prospects up to 1985. Conservation and structural shifts in energy demand from oil to other sources may show significant results in the longer term, especially in the 1990s.

The range of energy supply and demand outcomes in the USSR is a significant issue in the current Eleventh Five-Year Plan (1981–

*Senior Specialist in Soviet Economics and Associate Director for Senior Specialists, Congressional Research Service, Library of Congress.

1985) and may be important in the leadership succession debate in the Soviet Union. Energy issues may take on increasing gravity, either if oil production losses are to require them to become net importers, or if they are able to substantially expand their energy supplies.

Soviet leadership and planners have options that could significantly influence their ability to utilize their rich energy potential. Taking full advantage of the potential will be difficult since it demands a sharp rise in resource allocation to energy programs from other priority programs including the military; a significant reorganization of energy administration; and a long term energy policy beyond the tenure in office of the current Brezhnev regime. However difficult the shaping of new energy policies seems, the alternatives—leading eventually to a worst case situation—have serious implications.

. . . Energy issues will have a significant and increasing role in intra-East European relations, Soviet relations with Western Europe, with the Middle East, the developing South, client states such as Cuba and Vietnam, and the United States.

U.S. interests may be especially affected by Soviet energy policy because of Soviet ability to restrict Western supplies of Middle East oil. In turn, U.S. actions in the Middle East and in energy equipment export policy will affect Soviet energy policy.

Possible future energy cooperation between the United States and the Soviet Union might have an *important* potential for *marginally* increasing Soviet energy output, especially in the long run. Control of future energy equipment exports is likely to have a limited, short term effect on Soviet energy performance.

. . . Energy issues ranging from competition for sources to cooperation in production may be major foreign policy agenda items in U.S.-Soviet relations:

The effectiveness and impact of United States and Western policy of either cooperation or competition will differ markedly if the Soviet Union is faced by a severe energy shortfall and becomes a net importer or if the USSR is able to cope with its energy supply problem and is able to engage in energy diplomacy.

In U.S.-Soviet affairs, *if relations improve*—energy cooperation might be the bellweather of normalized economic relations. If not, competition for supplies of OPEC energy and control of Western energy equipment exports might be central points of controversy.

In East-West relations, *if there is cooperation*, then ventures such as the All-European energy meeting following the CSCE Madrid meeting in 1981 will be important. *If there is competition*, conflict in the Middle East and elsewhere for access to limited energy supplies and restrictions on trade in energy equipment will be the order of the day. The financing and construction of the Northern gas pipeline from Siberia to West Europe could be a divisive issue in the West.

Specific Prospects

The specific prospects are keyed to relevant chapters for more detailed discussion.

Energy Supply Prospects for Soviet Union and CMEA Are Uncertain (chapters II and III)

Leveling off followed by sharp fall in Soviet oil output by 1985 is more a possibility than a likelihood in our assessment.

The CIA view from 1977 to 1981 has been that the output will fall from under 12 million barrels per day in 1980 to 10, quite possibly to 8, by the mid-1980's. This view is based on a combination of negative conditions: a sharp fall in major West Siberian field output due to overproduction and an inability to bring in new oil reserves. The CIA estimate centers on the decline of the giant Samotlar field in West Siberia and the likely coincident leveling and subsequent sharp fall of Soviet national oil output. This view was modified to 10–11 mbd in 1985 in a spring 1981 reassessment, still the low estimate or "worst case."

It is important to distinguish between a likely "worst case" and a political, economic, geological and technological "worst case". In any of those senses the CIA case is not the worst case. Moreover, the "best" case seems unlikely from these same viewpoints. The "worst" case [CIA] and "best" case [ECE] are chosen as the authoritative range of likely outcomes deriving from most detailed Western intelligence analysis [CIA] and the official international analysis [ECE].

The CIA view further argues that only equipment now on order, in the export pipeline, or in place can materially influence the efficiency of extraction or exploration and that few options are open to the Soviet energy industry for improvement in performance from domestic sources in the time frame of the current Five-Year Plan (1981–85).

Other views within the U.S. intelligence community and views among European energy specialists, including the Economic Commission for Europe (ECE), tend to treat the CIA estimate as a "worst case." By contrast, they evidence more uncertainty as to the fall of West Siberian oil recovery rates; more optimistic expectations for proving out and bringing in new reserves, especially in West Siberia; and higher likelihood of maintaining output levels in other regions than West Siberia or avoiding sharp reductions in output.

Increasing deliveries of Middle Eastern oil to the smaller countries of East Europe are possible in the 1980's with expanded pipeline facilities and use of tankers. However the hard currency payments required will increase each year, assuming Soviet deliveries stay constant, and pose a heavy balance of payments burden over time.

Policy options are open to the USSR to sustain high production levels, and there is a range of outcomes in future years, even prior to 1985. These are factors in the Soviet and other "best" case estimates.

The most optimistic view is that of the European Commission for Europe. The Commission predicts that Soviet oil output will continue to rise to about 14 million barrels per day in 1990—even though the "monster" field Samotlar peaks in the 1980s. This estimate was reduced from an earlier estimate of 16 mbd for 1990 and 14 mbd in 1985 by the ECE. It is difficult to substantiate the offsetting evidence of new resources without better reserve data, improved recovery rates or other developments prior to 1985 that would sustain oil production increases. Most West European authorities take a middle ground between CIA and ECE projections, predicting a leveling off or modest decrease in output of Soviet petroleum.

A step-up in exploration, an improvement in methods of recovery, an increase in the use of foreign equipment and management technology are all factors that can help to sustain oil production levels. Even accepting the potential of these changes, there is some question as to how soon changes might favorably influence output of petroleum. There is a reason to believe that if all the available options are utilized, a short term slowdown *may* be followed by improved growth rates in oil output after 1985. But growth will not take place without new discoveries. *New discoveries and improved recovery rates are the key to increased or even level production.*

The uncertainty about the accuracy of Soviet estimates of their own reserves and the acknowledged inability of energy experts to accurately predict future recovery rates should be stressed. Soviet secrecy policy on oil reserves data compounds the Western estimating problem. The combination of secrecy and inability to accurately predict recovery rate changes is a usual preliminary caveat cited by non-CIA Western assessments of future Soviet petroleum performance.

As a result, most estimates, other than the CIA's, arrive at higher estimates ranging from modestly slowing to slowly decreasing oil output, rather than a sharp fall in output, in the current plan period 1981–85 (inclusive). Furthermore, many note that the Soviet pattern of commitments to expand energy infrastructure for domestic use and deliveries of petroleum and petroleum products seems compatible with this higher range of forecasts. These actions suggest that the Soviets expect a continued adequate energy supply and support their moderate case scenario predictions for energy, including the 1985 target of 620–645 MMT or 12.4–12.9 MBD in Soviet plan guidelines.

A central distinction in this study from CIA, ECE, or other projection is the emphasis on ranges. Even Soviet planners have difficulty establishing precise outcomes 5 to 10 years out in energy performance, especially oil supplies.

Soviet Imports From the Middle East for CMEA (chapter III)

The Soviet Union has engaged in energy trade for years with Iran, Iraq, Libya, Algeria and Afghanistan. Increasing this trade depends on the Soviet's balance of payments capability and ability to use political/military influence to obtain more favorable delivery terms. Soviet energy trade even appears possible with conservative Arab countries, such as Saudia Arabia, if the price and political circumstances are right. Soviet imports from most OPEC nations are likely to be for hard currency at the world market prices. Even with increased arms and gold sales the USSR has limited capability to increase its hard currency earnings. Credit, countertrade, and compensation agreements appear less likely in the future with OPEC countries than with the Western industrial nations as a means to provide additional balance of payment benefits. Soviet sales of petroleum products and natural gas are projected to continue to be the major single source of hard currency for trade with the West. A Soviet turnaround in energy trade, as originally suggested by CIA, from substantial hard currency surplus earnings of around $10 billion a year to more than double that in the opposite direction would be difficult, if not economically impossible for the Soviets to sustain.

Over half the hard currency income of the USSR in recent years has come from petroleum sales. A reversal of energy trade from net oil exporter to importer would pose severe balance-of-payment problems. Additional arms, gold, raw material (other than oil), and indus-

trial product sales all seem limited options. Beyond balance-of-payment prospects for financing oil imports lie political/military options.

The smaller East European countries plan increased imports of oil from the Middle East to provide for their growth in energy needs. The USSR has projected a constant 1980 delivery level to Eastern Europe for the decade.

With Soviet supplies of oil to East Europe (CMEA) held to 1980 levels as planned and gas exports increased, the economies of East Europe are planned to grow more slowly. In addition, East Europe will obtain additional oil from the Middle East and pay for needed imports, with considerable difficulty.

CMEA countries plan a sharp reduction in energy intensive industries, a significant increase in indigenous energy output—including nuclear—and an increase in oil purchases from the Middle East. For the latter, the Adria pipeline starting at the Adriatic Sea is critical for Yugoslavia, Hungary, and Czechoslovakia. Even with the best of outcomes, CMEA growth in GNP is likely to be less in the 1980's than in the 1970's. The increased prices of energy from the USSR, the greater demand for "hard" goods (goods that can be sold in the world market) and the financing requirements for importing OPEC oil pose difficult balance-of-payment problems for the CMEA countries.

It is assumed that pronouncements by the Soviet leaders that Soviet deliveries of petroleum and other energy sources to East Europe will increase or at least be held to current levels mean that reasonably firm commitments have been made. In the past Soviets have appeared to honor such commitments. Political observers of East Europe in the West argue that fragile political stability in East Europe is a further basis for assuming a serious committal of continued Soviet energy supplies to their CMEA partners.

Energy Supply to West Europe May Be a Critical Factor in Economic and Diplomatic Relations (chapter IV)

If the Soviet Union is able to continue to sell oil and expand natural gas exports, this capability will be an important factor in East-West economic expansion and a significant Soviet diplomatic tool. If shortages of energy force withdrawal from energy trade with West Europe, considerable economic and diplomatic opportunities will be lost by the USSR. The new natural gas pipeline from Siberia to be operating by 1985 may provide one-third of the Federal Republic of Germany's gas by the mid-1980's and generate both credit repayments and billions in sales.

For West Europe the Soviet Union is an important aspect of their diversified hydro carbon supply plans. The risks of interdependence with the East are weighed against the instability of Middle Eastern suppliers. The Iran-Iraq conflict highlights the Middle East supply uncertainty.

Reducing Domestic Demand for Oil Is Limited in the Short Term by Modest Prospects for Controlling Demand by Conservation and Shifting to Other Energy Sources (chapter V)

In the Eleventh Five-Year Plan (1981–85) energy growth, with oil contributing its traditional share, seems to be coupled to economic growth. Decoupling oil supply growth from GNP growth may be difficult in the short run in the USSR.

Natural gas, coal, hydro, and nuclear power may be significant in meeting new energy needs in the ten to twenty year period but

will have modest short term effects in changing relative energy supply shares. Notwithstanding the structural rigidities in energy use, the future effectiveness of Soviet energy policy turns in large part on the ability to bring non petroleum sources into the energy balance and sharply improve efficiency of energy use.

Such limited data as are available suggest that conservation programs to date, have been largely ad hoc, pro forma administrative measures that have often proven counterproductive to the objective of increasing the efficiency of energy consumption.

Some change in the structure of the primary energy balance, e.g. relative increases in gas, coal, nuclear energy, and hydro, will tend to offset a slower growth or fall in oil output in the Soviet Union and CMEA.

Soviet planners as well as the ECE project a rise in the total energy output with only a modest boost in oil output by reason of significant increases in relative and absolute output of natural gas, coal, nuclear, and hydro. This structural change in the Soviet energy balance is accepted by most Western analysts as possible; the question is, largely, how soon and to what degree? A number of problems in bringing about desired increases in each energy source are cited with an indication of major constraints:

Natural gas.—Proven reserves ample; transmission lines the particular bottleneck, e.g. large diameter pipe and compressor equipment. Conversion from oil to gas not a major technical problem in many uses. Planned increases for 1980–85 call for significant absolute and relative increments.

Coal.—Proven reserves in Siberia ample; on-site steam electric power stations being built requiring high voltage transmission capability to bring power to load centers pose technological problems. Increased production of economically usable coal is a problem in older European regions. Soviets claim to have solved the critical long distance transmission problem.

Nuclear.—Technology and safety considerations not a policy constraint. Output of nuclear equipment for electric power a likely limiting factor, e.g., reactor output.

Hydro.—Enormous East Siberian hydro potential being developed—giant Sayansk Station in East Siberia in current plans; distance from current consuming centers requires industrial expansion *on site* or long distance transmission beyond current world level of long distance transmission technology.

In the near term a growth in natural gas supplies due to completion of the Northern gas pipeline to Soviet domestic consumers, CMEA, and Western Europe might offset a modest reduction in petroleum supplies. Increased deliveries of large diameter pipe and other equipment from Germany and other Western countries make gas projections more credible. Coal, nuclear, and hydro electric power may be significant in the late 1980's and beyond, and in specific geographical areas sooner.

Because of the coupling of economic growth to petroleum output, the accuracy of near term Soviet oil output projections is especially vital.

CIA projects GNP growth rate will fall from about 4% to 2% with an oil output fall from 12 to 10 million b/d in 1985. Moreover,

Soviet GNP growth "could go below 1% in the mid-1980's, if oil production falls to 8 million barrels per day," according to Admiral Turner. This conclusion is based on fixed production relationship assumptions. As the key energy-consuming sectors are construction, machine building and the manufacturing industries in the USSR—not automobile use as in the United States—it is argued by CIA that a reduction in energy use would most likely lead to commensurate industrial growth reductions. It is further argued that short term technological improvements in the efficiency of energy use are limited.

The relationship of domestic energy consumption and economic growth in the USSR and CMEA in the long run need not be constant. Structural change in energy use may reduce demand for oil without impairing planned performance. Shifts in CMEA of new energy intensive industries to locations close to energy supply in Soviet Siberia may likewise reduce demand growth. Conservation is an active long term option.

In the longer term alternate energy sources may be substituted for oil. Oil is used for many purposes for which other energy sources could be used, e.g., steam and electric power generation. Therefore, increases in gas, coal, nuclear and hydro shares in energy balance are tied to the energy/growth relationship.

The regional shift of highly energy intensive industries such as the petrochemicals, chemicals, electro-processing industries to Siberia from East Europe and European Russia may facilitate the availability of energy supply where transportation by pipeline (gas) or transmission line (coal-hydro) is a bottleneck in energy use.

Geological Prospects for Continued High Level Oil Output in the USSR Are Uncertain. The Likelihood of a Turndown Is High From a Geological View; the Question Is When (chapter VI)

The Principles of Petroleum Industries Apply to All Countries, Including the Soviet Union. These Principles Indicate That the Largest Hydro Carbon Producer Is in for Some Serious Problems in Production. Specifically That as Exploration of a Basin Progresses, the Average Size of Oil Fields Being Found Decreases Dramatically as Does the Amount of Oil per Unit of Exploration (chapter VII)

Comparison of U.S. and Soviet Energy Situations and Options Indicate Similarities and Differences (chapter VIII)

The similarities include:

(1) *Shift to hydrocarbons.*—Each shifted rapidly in Post World War II years to oil, then oil and gas.

(2) *Uncertainty of future supplies.*—Each has been affected by the belated realization that domestic supplies of oil and gas are exhaustible and that this fact of limits on hydrocarbon reserves must be taken into account in domestic economic policy.

(3) *Increased future energy costs.*—Each is affected by spiraling exploration, production, and transmission costs of primary energy.

The differences include:

(1) *Exploration and potential reserves.*—The U.S. has undertaken extensive exploration and/or utilization of its probable energy reserves, the U.S.S.R. is still far from geologically

explored, especially in Siberian areas and their coastal shelf and may have as much as one third of the world's probable hydrocarbon reserves.

(2) *Energy system and equipment technology.*—The U.S. is a world leader in most forms of energy equipment and systems technology; the U.S.S.R. is less advanced and must import energy equipment. Likewise the U.S. is a leader in energy systems, reservoir engineering, transmission systems; the U.S.S.R. is not.

(3) *Energy trade.*—While the U.S. continues to be a major importer of both oil and gas, the U.S.S.R. can export natural gas in increasing amounts for the foreseeable future based on its reserves and likely domestic needs and maintain some exports of petroleum and petroleum products; CMEA as a whole, however, is likely to be a net oil importer.

(4) *Energy debates.*—Overall each country has reached a threshold point in energy development, each has its "energy debate", each has changed its energy organization to conduct the debate and implement its results. Each may change priorities and organization significantly to utilize available options to resolve long term energy problems. However, the nature of the energy problem, the character of the energy debate, the prospects of policy and organizational change are markedly different in each country.

Soviet Domestic Energy Policy Debates Reflect Options and Uncertainties (chapter IX)

The range of outcomes in the upcoming decade is probably bounded by the European Commission for Europe (ECE) estimates on the optimistic side and the CIA on the pessimistic side. Perhaps both of these projections are improbable as precise predictions, but may be useful as ranges. The inherent uncertainties in proving and producing oil and the priority given to production are likely to determine precise output. Policy options open to leadership range widely to the year 2000. Internal Soviet debates on energy policy which have surfaced apparently reflect uncertainties on resource endowment and natural factors effecting performance as well as perceptions that significantly different outcomes may result from energy policy changes. The uncertainties are compounded by the usual bureaucratic inclination to interpret prospects and needs in terms of institutional or parochial interests. "Where they stand is determined by where they sit" in Moscow as well as Washington. Geologists are more optimistic if they might receive more funding for exploration. Production people are pessimistic in order to receive more resources and lower norms of performance, etc. Likewise, up to the top leaders, some prefer natural gas, nuclear, hydro, coal etc. as "the solution." Finally many have had different views on how urgent energy is as a national problem. Yet at the dawn of the 1980s it may be concluded that a consensus has arisen, energy is acknowledged by Soviet planners to be a major Soviet priority.

While Soviet leaders have accepted a form of interdependence, it is different from that of other industrial nations, i.e. they will export their scarce hydrocarbon treasures in petroleum products and natural

gas, but they indicate that they will be more reluctant to become net energy importers.

The overall debate may lead to any of several basic approaches to serious problems and may hold out the prospect of technical, economic, and political resolution of the Soviet energy problem. The possible scenarios appear to be along the following policy lines:

Comprehensive, complex, long-term energy plan and policy (Scenario I), Selective ad hoc programs and policy (Scenario II), Status quo policy (Scenario III).

Scenario I would be most certain to ensure performance approaching the best case forecasts in the decades ahead. Scenario II is descriptive of the incremental, remedial policy followed since the December 1977 plenum of the CPSU. Scenario III is generally the pre-Plenum 1977 policy, which may conceivably be revived.

In order to fulfill the levels of production in the ECE report or, probably those required by Soviet leaders today, a comprehensive, complex, long-term energy plan would need to be adopted in the Soviet Union (Scenario I). The central aspect of this approach that might be adopted as policy at an early date in the Eleventh Five-Year Plan would be:

(1) *An energy version of a Soviet defense policy council*, i.e., a centralized administrative authority such as the Heavy Industry Section of the Secretariat of the Central Committee of the CPSU, headed by V. Dolgikh. With full top level party support all Ministers and regional party authorities could be mobilized, including the Ministry of Defense Industries, for a broad, high priority long term energy program through an Energy Policy Council similar in membership to the Defense Policy Council.

(2) *Western efficiency measures would be surrogate Soviet energy success indicators.*—Norms for performance would follow the technical coefficients of the United States or Japanese energy consumption pattern. With the more efficient technical norms as objectives a program could be designed to uncouple GNP and energy—especially oil output growth. If the relationship were not 1:1 or higher as now but 1:0.5 or lower as in the more efficient Western nations, obvious savings would accrue in reduced demand. Likewise an improved energy balance might be designed using Western economic prototypes.

A number of more specific aspects of such a comprehensive, complex, long term scenario could be the following:

(1) A broad acceleration of the rate of exploration and proving out of energy reserves, especially in petroleum, in both established and new petroleum regions. This does not necessarily involve areas requiring new technology, such as Arctic areas like the Barents Sea, but East Siberia, Caspian, and the continental shelf in the Pacific.

(2) A simultaneous increase in the domestic production of energy equipment for developing various energy sources. This wide-scale effort would presumably require a defense-type priority, coordination of directives and support from the top levels of the Party. A military-type priority would include inter-

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relating the military construction facilities and the Ministry of Defense Industries into the top priority energy programs newly placed under military jurisdiction. More and better hydrocarbon, coal, and nuclear equipment might be produced in the technologically advanced Ministry of Defense Industries. This broader domestic base of equipment supply might be enhanced by the relative efficiency of military-industrial administration.

(3) An acceleration of the nation-wide system of energy transmission, especially permitting available natural gas to reach the primary domestic and foreign consuming centers. This might involve early construction of a second Orenburg pipeline from the Urals to the Czechoslovakian border and an increase in the number of lines for bringing more Tyumen Province gas to European consumers via the Northern gas line, with the Urenyoi or Yamburg field as the points of origin.

(4) Increased domestic R&D, stepped-up imports of high-technology foreign energy equipment and cooperative ventures with foreign energy enterprises would enhance the likelihood of the scenarios of the comprehensive plan. Early emphasis on oil exploration and production in West Siberia and gas collection and transmission in East Siberia (Yakutia) would be high on this list of technological imperatives. Joint Soviet-Western research and development in long-distance transmission and an enhanced priority for bringing surplus Western Siberian coal-fueled power and East Siberian hydrogenerated power to the domestic energy consuming centers would assist the needed shift in the primary energy balance.

(5) An increased investment in energy-intensive activity in Siberia, including the integrated Baikal-Amur Railroad (BAM) project. Further development in East Siberia, West Siberia, and Central Asia could provide increased output in energy-intensive activity for domestic needs and exports. The initial priority would probably be materials processing (e.g. aluminum, wood products, copper, etc.).

A comprehensive energy program would necessitate dealing with all of the questions noted above, but not necessarily carrying each forward with the same high priority.

Two other scenarios may result from the current energy discussions. In our conception they would be variants on the comprehensive plan (Scenario I): A Selective, Ad Hoc Program (Scenario II); and a Status Quo Program in Energy Policy and Administration (Scenario III).

Scenario II would probably continue to focus on Western Siberian oil production in the short run in an attempt to hold the level of oil output up, delivering substantial natural gas fuel to critical domestic and foreign consumers (especially larger cities and fuel deficit regions). Some Western energy specialists feel that, with sharply enhanced exploration leading to new discoveries and with improved recovery methods, West Siberian and total oil output may be maintained and possibly modestly increased. Ad hoc efforts in natural gas transmission would alleviate critical domestic shortages and provide needed currency. This selective, ad hoc approach might be character-

ized as muddling through and appears to sum up the policy that emerged from the December 1977 Party plenum. At that meeting it was apparently decided to shift production crews from other regions to West Siberia and shift some exploration drilling crews to production. This "robbing Peter to pay Paul" type policy, characterized by some recent year shifts from Ural-Volga to West Siberian fields and back and from exploration to production assignments of limited drilling crews and rigs, seems to indicate either a lack of awareness of long-term energy needs or, more likely, an unwillingness to give military-like priority to energy over other competing claimants on resources outside the energy area.

A status quo policy (Scenario III) involving little change over pre-1977 policies would be likely if other priorities seemed to be more urgent than the evident needs of energy program improvement. These higher priorities are traditionally in the military areas. A collapse of arms discussions, challenges or opportunities in Asia, or a procurement need for a sharply enhanced Third World military role might be the policy justifications for a return to a status quo policy. An unsettled leadership and an European or Asian crisis might also be an environment for such a scenario. However, the domestic and foreign economic costs would be high. The political costs in East Europe and elsewhere would be significant. Even without energy exports to the West a shift of investment resources away from the energy area would lead to severely limited energy supplies in the U.S.S.R. and have a retarding effect on domestic performance. Reversion to the pre-1977 policy might follow an Afghan invasion stock taking if the leadership opted to further increase the current military/control priorities.

The range of outcomes from the worst to the best case varies for those willing to be influenced by the choice of scenarios. If Scenario I (Comprehensive) were chosen and the uncertainties developed favorably, then the ECE forecast seems possible even though optimistic in the 1980s. If Scenario III (the Status Quo) were chosen and the uncertainties developed badly, then the lower performance of CIA projections seems reasonable, indeed likely.

Just what the precise playing out of the scenarios within the decade of the 1980's might be is difficult to estimate. It should be noted that CIA estimates focus on the period to 1985. Indeed although the next five years may be a difficult time for the Soviet petroleum industry, the following five years (1986–90) may be even more difficult unless resolute action is taken now. Assuming CIA estimates on proven reserves, likely recovery rates, and knowledge and utility of foreign imports are correct, then a leveling off and reduction in oil output may be "inevitable." However, this degree of certainty concerning Soviet energy prospects with information so controlled by secrecy laws and characterized by uncertainty is puzzling. Therefore, CIA statements on future output seem best characterized as estimates or possibilities.

On the other hand, there is no assurance that even the comprehensive energy program would assure increased oil and other energy supplies as planned. There is a possibility that major, costly efforts and sacrifice may be followed by unsatisfactory results. This prospect may deter Soviet leadership decisions involving significant current

resource allocations, many political risks, and uncertain future outcomes.

In this context a successor to Brezhnev, emphasizing economic performance, may opt for either a high energy priority with military administrative support (Scenario I) or a revival of a Stalinist control system with no new priority to deal with energy problems (Scenario III). The commitments of the Brezhnev leadership and policy to date suggest a selective, ad hoc policy (Scenario II) may continue, but would seem counter to leadership calls for a new, comprehensive policy at Party meetings in 1978 and 1980.

The political and economic costs of failure to meet minimum plan needs appear to be very serious to the Soviet Union and the CMEA. Shortages of oil or alternative energy supplies might lead simultaneously to slower economic growth in the U.S.S.R., and even more serious slowdown in the smaller energy-poor countries of CMEA, and an inability to finance the imports that petroleum sales have provided hard currency for in the past, with an attendant requirement to find a hard currency export substitute.

The Soviet Union received over $11 billion in 1980—half of the total export revenues in hard currency—from sale of petroleum and petroleum products. This amount would cover the cost of grain imports. Other exports including industrial goods, non energy materials, gold, military equipment, merchant marine earnings, make up the remaining foreign income. Natural gas exports, military sales, and tourism income may modestly increase in future years. Replacing petroleum income and finding non oil export sources of hard currency income to continuously pay for petroleum imports from OPEC countries would be difficult.

The limited balance of payments prospects for financing large petroleum imports over a long period suggest that non-economic measures must be pursued if increased imports of oil and gas are to be assumed; e.g.

(1) Control of Iran and/or Iraq.

(2) Leverage over Saudi Arabia, Kuwait, Libya, Algeria, and United Arab Emirates.

(3) Some variants of 1 or 2.

Military ventures or an extension of political control over Middle Eastern oil producing nations are possibilities, but unattractive options for the Soviets, in our view. What these kinds of outcomes suggest is economic disaster for the Soviet Union/CMEA. It is difficult to believe that Soviet leaders will not choose other options to attempt to avoid very serious energy deficits and economic and political crises. Moreover, energy sufficiency would give the Soviet Union an economic lever for energy diplomacy that might match or exceed its traditional use of political/military bases of diplomacy.

Implications for U.S. Policymakers Range From Embargo to Interdependence (chapter X)

1. What impact might Western energy technology imports have on Soviet or CMEA energy output? How unique is U.S. technology, how effective is export control? Is a foreign or domestic policy constraint on U.S.S.R. likely to arise from our energy equipment export policy?

It seems clear that the Soviets desire Western, especially U.S., technology for energy exploration and extraction; but the conclusion that

they are uniquely dependent upon the United States for energy equipment is subject to question. The ability of the U.S. to effectively influence Soviet oil production or other Soviet activities with the use of export controls on energy equipment may therefore also be subject to doubt.

2. Does the U.S. have the capability to hold down Soviet oil output? If so, do we wish to encourage a decline in production, if it increases the prospects that the Soviet Union and Eastern Europe may become net importers of energy?

There seem to be three schools of thought on this issue:

(*a*) *Nothing will help them in the short run school.*—The Soviet Union may be in the world market for oil regardless of U.S. energy technology exports. It is likely that Soviet oil production will sharply decline in the 1980's and that domestic efforts as well as imports of U.S. technology will not have an appreciable effect in the short run, i.e. up to 1985. This appears to be the CIA view.

(*b*) *U.S. sole supplier, critical margin school.*—Much of the energy equipment and technology desired by the Soviets is available primarily or exclusively in the U.S. Much of this equipment is essential to the Soviets and they have a *critical* need for it. Because of this critical need, the U.S. has an effective lever which may be used to influence Soviet behavior. Short run influence over the Soviet export-import position is possible and desirable through a manipulation of key U.S. energy exports. This appears to be the Huntington/National Security Council view held by the Carter administration.

(*c*) *Long-term cumulative impact school.*—The U.S. is likely to be of modest influence over the Soviet petroleum export-import position in the short run, but may have incremental influence over the medium and long run. All petroleum equipment and technology, it is argued, is available from other Western industrialized countries in sufficient quantity. If we refuse to sell to the Soviets, or try to link energy exports to political behavior, the Soviets will go elsewhere to buy their energy equipment. They may even go elsewhere for their first choice. In the long run, the U.S. may have significant influence if interdependence between East and West grows, especially if Western systems of energy management are transferred to the Soviet Union. This appears to be the view of a wide range of non-governmental academic and industrial specialists in West Europe.

Related to but not necessarily derived from these three different perceptions of relationship between energy technology and Soviet petroleum industry performances are the following policy options: (1) to deny across the board the export of technology and goods which could make any contribution to the military and *economic* potential of a Communist country; (2) to link the technology directly and explicitly on a penalty/reward basis to Soviet behavior on a wide spectrum of issues such as human rights and activities in the Third World; and (3) to play down direct, explicit linkage of trade with other issues and develop long-term general benefit/penalty influence pattern on Soviet behavior with increased trade and interdependence. All would be more effective if they were unified Western policies.

Each of these options may be related directly to the subject of U.S. energy technology exports to the U.S.S.R. in terms of the following legislative policy options.

The Embargo of Energy Technology

This policy option, characterized in the 95th Congress by the proposed Technology Transfer Ban Act of 1978, would deny all energy technology to the Communist countries, on the assumption that much or most of the fuel produced in these countries with American equipment would contribute directly or indirectly to military strength. A number of resolutions after the Carter sanctions in 1980 called for an embargo of some trade with the U.S.S.R. Associated with this approach, is the assumption that U.S. energy technology can significantly affect Soviet oil production and exploration and that denial of that technology would be in the best interest of U.S. foreign policy objectives, while detrimental to Soviet interests.

Critics pose these questions: Has experience to date suggested that U.S.-Soviet trade is a zero sum game? If we are losing export sales and gaining only marginal or questionable influence over Soviet oil production, what gains have we made?

"*Creative economic diplomacy*"

This policy option, spelled out in the letter from President Carter to Speaker O'Neill after the sanctions, would attempt to use U.S. energy exports as a lever in U.S. Soviet relations on foreign policy grounds, when the equipment and technology are of "critical need" to the Soviets and when the Soviets are "largely dependent" on U.S. supply. The concepts of critical need and dependency have been controversial. Measuring or assessing the Soviet need or reliance on U.S. technology has not been established to the satisfaction of many specialists. James Giffen, speaking for the American industry view while testifying before the House Foreign Affairs Committee, stated that: "A substantial quantity of all geophysical equipment in use by American oil companies is available overseas with no reduction in quality and reliability." Others have suggested that indeed the U.S.S.R. has a critical need for certain U.S. energy technology which is not available abroad.

Which view is correct on the short term effectiveness of energy equipment export denial? Who should accept the burden of proof, those wishing to sell energy technology to the U.S.S.R. or those proponents of export controls? The several disapprovals of the Dresser drilling bit plant sales to the USSR on technology transfer grounds and the approval of Caterpillar pipe laying equipment by the Carter Administration seemed to add confusion to this policy.

Energy and Economy Interdependence

This policy option implies that a continued long-term cooperation between the U.S.S.R. and the U.S. and the industrial West on energy, as expressed through trade, will increase the ability of the U.S. to influence Soviet activities. Exporting U.S. energy equipment over a long period would play down possible short-term influences and in the long-term be mutually beneficial to the U.S. and U.S.S.R. Such a development would be in the economic and foreign policy interests of the U.S. it is argued, while consistent with our current export promotion and export administration laws.

Does experience indicate that long-term influence via trade is possible? Should only minimal influence be possible even in the long run, would the economic benefits derived be reason enough for trade?

According to Marshall Goldman, Associate Director of Harvard's Russian Research Center, testifying before the House Foreign Affairs Committee on export controls, "overall it seems in the best interest of the world that it should seek as high a production of basic raw materials such as oil, natural gas and coal as possible regardless of who is the producer. It is true that if the Soviets are the producers, that it also strengthens the Soviet Union, but at the same time we should have as many diversified sources of supply as possible." In this respect increased trade is seen as mutually beneficial rather than as a zero sum game.

Possibly the most economically beneficial arrangement for the Soviet Union in technology transfer would be one in which a long-term contractual relationship were established with Western companies as general contractors, partners in management of transfer and cooperative agents in the marketing of products. Joint ventures are the usual form of such a collective relationship which U.S. multinationals employ effectively elsewhere. Some aspects of this arrangement, including equity and foreign managerial involvement in decisions, have been politically unacceptable to the Soviet Union, but encouraged by the Yugoslavs, Romanians, Hungarians and Chinese. This arrangement, keyed to large complexes, might significantly improve the effectiveness of technology transfer and shorten the time required to bring projects on stream if adopted in U.S.-Soviet commercial relations.

From the American side a long-term commitment has the utility of providing an assured, expanding market with reasonably predictable returns on investment. The Germans, for example, appear to find their pipe-for-natural gas deals relatively attractive. This German energy trade pattern fits in with this policy option. The likely participation of ten European countries and Japan in the Northern gas line is illustrative of this view.

With appropriate concern for meeting national security criteria, identifying and controlling critical technology transfer and other exports as required by the Export Administration Act of 1979, a pattern of long-term relationship might be attractive in U.S.-U.S.S.R. relations.

What concerns the Soviets and West Germans alike in their relationship is the cost of interdependence, i.e. the mutual, increasing cost of dependence on each other. Notwithstanding, the Germans argue that the influence from this kind of relationship by the West would be substantial and would build over time. If imports from the U.S.S.R. were not critical, but valuable, we might find the dependence cost relatively modest, e.g. any amount of energy the Soviet Union is likely to be able to export to us would be a small part of our total supply. But in large projects critical to the Soviets our transfers to them might provide sources of considerable influence, e.g. a stoppage in delivery would create a bottleneck in project completion. Technology once transferred, however, cannot be recalled and its leverage is not comparable to that of needed raw material imports.

If cooperation is the policy to be followed, we might wish to join the Germans and Soviets in supporting the energy conference arranged through the ECE after the Madrid CSCE meeting in 1981 to foster multilateral energy cooperation.

If, on the other hand, we are thrown into or choose a competitive position on foreign oil supplies with the Soviet Union in which the reliabilities of foreign sources could not be controlled we might wish to explore a range of contingency plans of political-military exigencies. In that competitive mode American exports of energy equipment should be appropriately restricted and American efforts competitive for Middle Eastern oil sources by political/military means might be highlighted.

Finally and perhaps of most significance is the interaction of Soviet supply prospects on its diplomacy and our policy. Our diplomatic posture should be prepared for a two-track response:

If the Soviet Union is an energy deficient nation, either cooperation or conflict may be centered on potential Soviet direct or indirect intervention in the Middle East; or

If the Soviet Union is an energy exporter, either cooperation or conflict may be centered on their energy diplomacy in Europe, the developing South and elsewhere.

It is not clear which of these two tracks provides the greater challenge or opportunity for attracting U.S. interests. To prepare for both seems prudent.

The two track response relates to the effectiveness of our energy equipment supply diplomacy in dealing with the U.S.S.R.

If we have little critical, short term denial capability, the effect of foreign policy criteria in limiting energy equipment deliveries will be limited.

If we have significant long term potential in providing energy systems, then the use of these benefits could be an important tool in bilateral Soviet-American relations.

II. WESTERN FORECASTS OF SOVIET AND EAST EUROPEAN ENERGY OVER THE NEXT TWO DECADES (1980–2000)

By Jonathan P. Stern * **

A. Soviet and East European Energy Over the Next Two Decades

What is attempted here is to set out in some detail the dimensions of the near term CMEA energy balance and the broad indicators of the long term situation. This assessment will cover only the five years 1980–85 in any detail. The reason for taking such a relatively short span is that it is the longest period for which any prediction can claim reasonable degree of accuracy. One of the points we hope to bring out is that western commentators have been spectacularly unsuccessful in forecasting trends in the Soviet energy balance, even in the short term.

A further reason for selecting 1985 as the initial target prediction is that it is this date that the CIA forecast (in 1977) that the Soviet Union and Eastern Europe (the CMEA countries) would be importing 175–255 million tons of oil.

The approach adopted here is to examine the CIA analyses of the CMEA energy situation, using this as the "worst case" scenario. We shall then discuss other views of the Soviet and East European energy situation and comment on how events have borne (or failed to bear) out the various scenarios. Finally, a more speculative section will try to identify the major elements of the CMEA energy balance over the next two decades.

1. Soviet and East European Energy: The CIA "Worst Case" Scenario

The CIA has always held rather conservative views on Soviet energy production capabilities. In 1976, just after the Soviets published their five year plan, the Agency suggested that both the oil and natural gas targets would be underfulfilled by a considerable amount.[1] The real bombshell, however, dropped in early 1977 when the publication of three reports (two specifically concerning Soviet oil prospects and one on the general world oil situation) brought the energy situation of the CMEA countries into the limelight. These publications, which radically departed from the conclusions of other public materials, have given rise to a lively debate as other analysts have sought to support, amend or criticize the Agency and the latter has issued further reports with supporting evidence for its assertions.

Before entering a detailed discussion of the CIA reports, it is important to mention that the Agency has never published a full analysis of the CMEA situation which covers comprehensively the basis behind its conclusions. For example, it was never explained precisely how

*London Representative, Conant & Associates, Ltd.
**See Editor's Note, p. 54.

[1] *Soviet Economic Plans for 1976–80: A First Look.* ER 76–10471. August 1976.

Soviet production falling to 400–500 million T/Y to would lead to a CMEA import of 175–225 million T/Y. Thus a critique of the Agency's analysis requires a certain reconstruction of the logic behind the main conclusions.

The most important aspects of the original CIA reports [2] were the assertions that:

> 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 1980's. The maximum level of output is likely to be between 11 and 12 mmbd (500–600 million tons), but it is not likely to be maintained and the decline, when it comes, will be sharp. Before 1985, the USSR probably will 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. Although there will be some substitution of coal and gas for oil in domestic use, the scale of such substitution will be small before 1985. Neither hydroelectric power transmission from the east, nor the construction of nuclear powerplants can afford much relief until well past 1985. We estimate that the Soviet Union and Eastern Europe will require a minimum of 3.5 mmbd/(175 million T/Y) of imported oil by 1985. At worst, slumping production could lead to import requirements as large as 4.5 mmbd (225 million T/Y).

The purpose of this long quotation is to show the extent to which this report challenged what could be described as the "conventional wisdom" of western analysts on Soviet energy (and specifically oil) prospects. The report was revolutionary in a number of assertions:

1. That Soviet oil production would peak *soon* and at less than 600 million T/Y. The slowdown in the rate of growth in Soviet oil production had been noted by other analysts, but the Agency was the first to assert that maximum sustainable production had been reached.

2. That Soviet oil production would *decline* immediately and sharply after the peak to a maximum 500 million T/Y. Even those who saw production leveling off were not predicting a decline in totals. Most had suggested that the Soviets would get fairly close to their target of 620–640 million T/Y in 1980 and that production would continue to increase slowly through the early 1980's.

3. That Soviet exports of oil would cease *entirely, prior to 1985*, to be replaced by imports of oil from the world market. Most analysts had been prepared to admit that the Soviets would be hard pressed to maintain oil exports to the West beyond 1985. The CIA was the first to assert that Eastern Europe would be deprived of Soviet oil so soon, let alone that the Soviets would need to import oil on their own account.

4. That the situation could only be marginally affected by Soviet development of other fuel sources, primarily gas and coal. Other analysts were beginning to point to the large contributions that natural gas could make to the CMEA energy economy and also the possibilities suggested by the extremely large coal resources base.

In sum, the CIA reports were revolutionary in that they suggested that the USSR was in dire energy straits to the point where large quantities of oil would have to be procured from outside the CMEA region and that there was no way out of this situation.

Criticism of the CIA view on the Soviet oil situation, mainly on the grounds that it was a political ploy which attempted to show the U.S. energy situation, and the policies of the Carter Administration, in a better light, somewhat undermined the credibility of the 1977

[2] *Prospect for Soviet Oil Production and Supplemental Analysis.* April and July 1977. *The International Energy Situation: Outlook to 1985.* April 1977.

reports.[3] Nevertheless, in subsequent publications, the Agency stuck to its forecasts and in mid-1979, as part of its report on the world energy situation, published a further analysis of the Soviet situation.[4]

The CIA analysis of Soviet oil production had changed little in two years with the Agency continuing to assert that output would peak in 1979 or shortly thereafter and would decline to 400–500 million T/Y by 1985. The 1979 report continued to assert that Soviet proven oil reserves amounted to just barrels 4.1–4.8 billion tons or about half the "average" western estimate. However, the question of waterflooding of oil fields as a major cause of production decline, so prevalent in the 1977 reports, did not appear again in 1979, giving the impression that the Agency production forecast was primarily based on its assertion of the inadequacy of the proven oil resource base.

On the question of Soviet and East European imports of oil, the 1979 report is rather difficult to follow, but table 1 sets out the main features and differences between the 1977 and 1979 reports.

TABLE 1.—CIA ESTIMATES OF SOVIET AND EAST EUROPEAN OIL IMPORTS (EXPORTS)

[In millions of tons]

	1978	1982	1985[1]	1985[2]
Soviet Union	(150)	(85)	55	175–225
Eastern Europe[3]	100	120	120	

[1] 1979 forecast, extremely difficult to work out what is actually being predicted. See the "World Oil Market," pp. 40–42.
[2] 1977 forecast.
[3] Including Yugoslavia.

The most recent, and rather less publicized, statement by the Director of the CIA, published in 1980, shows that a dramatic change has taken place in the Agency's analysis with respect to CMEA imports of oil. In testimony to the Senate Energy Committee, Admiral Turner noted that, ". . . the Communist countries as a group are projected to shift from a net export position . . . to a net import position of at least 1 million b/d (50 million tons per year) in 1985." [5] Although the Director's statement reiterated the belief that Soviet oil production in 1985 would not exceed 500 million tons, it is clear that the Agency has backed well off its 1977 prediction of net CMEA imports of oil reaching 175–225 million tons by the mid-1980's. More importantly, the most recent statement, by implication concedes that the Soviets will not need to import oil for themselves in the next five years.

These then, are the major elements of the CIA analysis of CMEA oil prospects. It has been termed a "worst case," because it is the most pessimistic scenario to have been put forward (although Admiral Turner's most recent statement puts the Agency back into the mainstream of predictions on the CMEA oil deficit in the mid-1980's. The reason for giving the scenario such attention is that, at least in the U.S., it has been greatly influential in shaping informed thinking

[3] *The Soviet Oil Situation: An Evaluation of CIA Analyses of Soviet Oil Production.* Staff Report of the Senate Select Committee on Intelligence. U.S. GPO. 1978.
For a full account of the CIA reports and the various interpretations which have been put upon them, see: Marshall I. Goldman. *The Enigma of Soviet Petroleum:* Half Full or Half Empty? George Allen and Unwin. London 1980.
[4] *The World Oil Market in the Years Ahead.* ER 79-10327U, August 1979.
[5] Admiral Stansfield Turner. "The Geopolitics of Oil." Statement to the Senate Energy Committee. Reprinted in *Petroleum Intelligence Weekly,* Special Supplement. May 19, 1980.

about the Soviet energy situation. Before progressing to what this author feels is the most likely scenario, it may be useful to summarize a broad range of opinions which have been gathered from discussions and published material on both sides of the Atlantic. This research focused on three major questions: the size of Soviet oil reserves, the prospects for Soviet oil production and the prospective net CMEA oil trade surplus or deficit.

2. Soviet and East European Energy: Differing Western Perspectives

There is an instantly apparent division of expert opinion between American and European analysts. Broadly speaking, although only one U.S. commentator accepts the CIA analysis in every detail,[6] it is clear that Americans attach a great deal more credence to the reports than do Europeans. On specific points, the following seems to emerge:

1. No European analyst is prepared to accept the CIA estimate of Soviet oil reserves (but everyone is equally skeptical of the Swedish estimates which state that Soviet proven oil reserves rival those of Saudi Arabia), whereas U.S. experts have less difficulty with the estimate, mostly noting that it is "pessimistic."

2. Few European analysts see Soviet oil production falling substantially prior to 1985. Most see totals rising until that year (albeit rather slowly) and leveling off at 650 million T/Y. Only one source was prepared to accept the possibility of rapidly falling production after 1985. Americans tend to see production stabilizing around the 600 million T/Y level and falling slightly by 1985; few Americans share the CIA prediction of a precipitate fall to 400–500 million T/Y by the mid-1980's although some do not rule this out by the end of the decade.

3. None of the commentators would accept the initial CIA prognosis of a CMEA oil import of 175–225 million tons in 1985. Americans were prepared to forecast CMEA imports in the range of 50–100 million T/Y in the mid-1980's; Europeans generally forecast 0–50 million T/Y.

There appears to be a difference of opinion within the U.S. intelligence community on these matters with the Defense Intelligence Agency (DIA) considerably less pessimistic on Soviet energy prospects than the CIA. In testimony to the Joint Economic Committee, the Director of the DIA, General Eugene F. Tighe Jr., noted that, ". . . we expect the growth in oil output to slow in the 1980's . . . the overall supply of domestic energy in the USSR will continue to expand in the foreseeable future, allowing steady, though somewhat slower, growth in economic output."[7] When asked about the differences in projections of Soviet economic growth between his Agency and the CIA, a Soviet economic analyst at the DIA stated, "The difference in our two predictions is, in fact, based on the oil prediction. We expect Soviet oil production to continue to increase through the 1980's. CIA's prediction is for something like a 15–30 percent reduction in oil output by the mid-1980's."[8]

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[6] Arthur A. Meyerhoff, *Soviet Petroleum: History, Technology, Geology, Reserves, Potential and Policy.* Discussion Paper No. 10. Association of American Geographers Project on Soviet Natural Resources in the World Economy.

[7] *Allocation of Resources in the Soviet Union and China—1979.* Hearings before the Subcommittee on Priorities and Economy in Government, Joint Economic Committee of the United States. Part 5. Executive Sessions June 26 and July 9, 1979. p. 88.

[8] *Ibid.*

The forecasts of the Continental Europeans are the most difficult to reconcile with the CIA report. If these scholars were on the fringes of the subject then their views could possibly be discounted, but more than anyone else these analysts have wide and regular contact with Soviets and East Europeans. Their testimony was impressive and full of direct quotes from conversations with officials in middle to high positions in the communist countries. Interesting points of agreement between these commentators include the following: they do not see the Soviet Union importing any oil for itself before 1990, neither do they see the Soviets importing on behalf of Eastern Europe unless such imports can be acquired on non-hard currency terms (which they doubt); so far from considering the question of imports, they tend to see the Soviet oil situation in terms of how oil exports (for hard currency) can be maintained; they do not see Eastern Europe (Romania excepted) being able to import sizable quantities of oil on anything other than barter/soft currency terms—they doubt that such terms will be acceptable to prospective suppliers; they feel that reduced energy availability will be reflected in reduced economic growth rather than a growth of oil imports.

Anybody who disagrees with these views, especially on the question of CMEA oil imports, must answer the following question: If the CMEA countries are going to import large quantities of oil from OPEC countries, where is the hard currency going to come from, given their current economic plight and particularly their current hard currency indebtedness? All these points are addressed in more detail below.

3. The Soviet View

The Soviets tend to be rather less than frank about difficulties being experienced in their economy. Articles take the form of stressing great achievements with shortcomings mentioned somewhere towards the middle of the text. Banner headlines of catastrophes and exposes of those responsible are not in the style of the Soviet press. In that context, one has to say that official circles are showing considerable concern about the fuel sector of the Soviet economy and this is increasingly being made public.

The important change in the reporting on Soviet energy problems is that these questions are being addressed not simply in specialized journals, but also in major statements by the Soviet leadership. President Brezhnev gave energy problems special prominence in his speech to the Party Plenum in November 1979.[9] More recently, at the June 1980 session of the CMEA, Prime Minister Kosygin underlined the difficulties for the USSR of keeping other CMEA countries supplied with fuels: "Having evaluated the needs of the fraternal countries, (The Soviet Union) will preserve the delivery of oil to the CMEA countries during the 1981–85 period at the level achieved in 1980 and will deliver almost 400 million tons during that period, *despite the difficulties connected with worsening conditions of production.*" (Italic added.) [10]

The basic question with regard to oil is whether West Siberian production can continue to increase and compensate for the expected

[9] *Pravda.* November 28, 1979, p. 2.
[10] *Ekonomicheskaya Gazeta.* No. 26. June 1980. p. 19.

declines in the older fields. The CIA has suggested that neither development can take place and certain recent Soviet publications support this view. A member of the Secretariat of the Communist Party writes that, ". . . by 1985, in accordance with the (oil) requirements of the country, it will be necessary to more than double the volume of drilling. With today's technology and drilling rates, this would require an increase in the drilling workforce of 100,000 men. This is of course not possible. The only way is through new techniques, new technology and rises in labor productivity." [11]

On a related subject, a senior oil industry commentator has sharply attacked oil industry techniques and the ethic which has continued through the 1970's of pushing for big annual production increases, noting that, "Preliminary research indicates that if current rates of increases in the numbers of new wells and the rate of increase in the coefficient of depletion are kept up, then oil production will reach a maximum within a relatively short time and after that begin to decline." [12] This commentary is particularly important in that it bears out and reinforces many of the points made in the original CIA reports, published in 1977.

Greater frankness on energy matters in the Soviet Union has undoubtedly been aided by the Kremlin's desire to rebut the CIA analyses.[13] Soviet oil production for 1985 set at 620–640 MMT in the 11th Five Year Plan is about the same as the 1980 targets.[13a]

As far as reserves are concerned, there has been no comment (probably because there is no wish to give even a hint of a figure which is a state secret), but there are signs of considerable concern on this subject, including the admission that discovery and preparation of reserves have not kept pace with oil production in the 1970's. There is also greater emphasis on the need for increased exploratory drilling.

With respect to oil production, it is now generally recognized that this cannot continue to increase indefinitely and although it has been claimed that totals will increase through 1990, the stronger impression is that production will peak in the future at a level that the country will attempt to hold through 1990. It is accepted that the west of the country will provide a decreasing volume of oil and the major effort has been transferred to Western Siberia where, it is claimed, production can continue to increase in the foreseeable future. However, in the USSR, as elsewhere, there appear to be considerable differences of opinion as to the means of dealing with the problems and the likely prospects.

Nevertheless, the emphasis on Western Siberia as the major oil producing region for the remainder of this century confirms the suspicion that the Soviets have shelved the motion of discovering a new oil province that the late oil minister, V. D. Shashin, had advised would be necessary for the future of the industry. One now finds comments such as, "The next Tyumen will surely be Tyumen itself,"

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[11] V. I. Dolgikh, "Povishat' Uroven' Rukovodstvo Predpriyatiyami Toplivno-Energeticheskogo Kompleksa." *Partiinaya Zhizn*, No. 1. January 1980. pp. 15–23.
[12] A. P. Krylov, "O Tempakh Razrabotki Neftyanikh Mestorozhdenii." EKO (Novosibirsk), No. 1. 1980. pp. 6–74.
[13] Boris Rachkov., "CIA's Prophecies About Soviet Oil Will Be Wrong Again." *Soviet News*. July 12, 1977.
E. I. Vertel'., "V Chuzhom Glazu." *Sovietskaya Rossiya*. August 31, 1979. p. 4.
[13a] Guidelines for 1981–85, 1986–90, *Pravda*, Dec. 2, 1980.

a reflection of optimism that a great deal more oil remains to be discovered in the region. Despite the disagreement, even within the USSR, on the oil bearing potential of the region, there is general consensus that a great deal more exploratory work (which has suffered at the expense of development drilling for big production increases) must be undertaken and that this effort will require massively increased investment expenditures. First impressions are that the capital investment program is being undertaken, but that for a variety of reasons, it is yielding decreasing returns, as the best prospects are drilled first.

As far as energy trade is concerned, it has been stated that Soviet energy deliveries to other CMEA countries will increase 20% in the period 1981–85 over the previous five years. However, on closer inspection it appears that this amounts to holding energy deliveries constant at the 1980 level during 1981–85. With regard to exports to the West, the Soviets have indicated a willingness to expand natural gas exports, while it seems to have been conceded that oil exports to the West will have to fall considerably.

The important question on which the Soviets have been abundantly clear is that they utterly reject any idea of Soviet oil imports of any magnitude in the foreseeable future. The prediction by a senior commentator that in 1990, other CMEA countries would need to import one half of their energy from outside the bloc, suggests that the USSR is only prepared to help out its allies to a limited extent.[13b] Soviet energy independence has always been and will remain an overriding priority in Soviet energy policy.

Soviet officialdom has come to see adverse western commentary on its energy future as part of the wider propaganda campaign by anti-communist forces. "These issues are a subject of ideological struggle, one of whose episodes is the CIA forecast designed for poorly informed and less than competent people."[13c] "Such forecasts (of Soviet oil imports) can be explained by the CIA's desire to back the assertion about the 'Soviet menace' to U.S. oil interests in the Middle East and make the public believe that the USSR is threatened by the same energy crisis now ravaging the West."[14]

Access to official Soviet sources is not good enough to know whether this is what the Soviets "really think". There is no doubt that even if the planners were expecting a serious near term oil shortage, the pages of Pravda would hardly be full of plans to import oil from the Middle East. Nevertheless, one factor is significant: The Soviets are acting as if they expect to produce more oil in the future. Massive investment is being devoted not just to exploration and production, but to laying additional pipelines and associated facilities that will be required to bring additional volumes from Siberia. These are facilities which would not be required if production, particularly in Siberia, were about to peak. All one can say for certain therefore, is that the Soviet oil industry is doing its utmost at least to prevent a decline in production. Its achievements in the past should make us pause before dis-

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[13b] Oleg Bogomolov, "Collective Quest for Solutions: The Fuel and Energy Problem in the CMEA Countries." World Marxist Review. August 1980. pp. 72–80.

[13c] *Ibid.*

[14] Boris Rachkov., "How the Soviet Union Views Future Oil Production, Exports." *Oil and Gas Journal.* December 3, 1979. p. 54.

missing its ability to do so. The achievements in the past (past production) maybe the reason for reserve problems in the future.

Altogether, it is difficult to disagree with the conclusion of a recent Soviet commentary that:

> While leaving aside what the CIA may think of how long Siberian resources may last, one might note that its published assessments have always attempted to minimize the USSR's available resources—what is noteworthy is that in the USA they are keeping a close eye on Siberia's oil, gas and other sources of energy, which naturally reflects not any delight at Soviet geological discoveries but a certain dismay over the fact that the socialist, not capitalist, world has the edge in world energy supplies.[15]

4. Soviet and East European Energy: Toward a Likely Scenario

A useful approach may lie in examining the events of the years since the worst case scenario was published. Like the CIA, this section will consider only the period up to 1985 and attempt to discover to what extent the radical assertions have been borne out.

Soviet oil production has not peaked. As the table shows, it has risen from 546 million tons in 1977 to 586 million tons in 1979 and 603 million tons in 1980.

TABLE 2.—SOVIET OIL PRODUCTION 1960–80

	In million tons		Annual percent increases
	Actual	Plan	
1960	147.8		1960–65=11.0
1965	242.4		1965–70=7.9
1970	353.0		1970–75=5.7
1975	491.0	496	8.6
1976	519.7	520	5.8
1977	546.0	550	5.1
1978	571.4	575	4.7
1979	586.0	593	2.6
1980	603.0	620–640	2.9

Source: Daniel Park, "Oil and Gas in Comecon Countries." (London: Kogan Page, 1979) table 2.4a, p. 41.

Nevertheless, the picture given in the table is very much one of an industry where the growth rate in production has slowed most dramatically, whether measured in percentage increase or actual physical increments. It is also an industry where targets are not being met and where the degree of underfulfillment was 37 million tons (with respect to the upper limit of the plan target) in 1980.

Against this, a number of positive features should be noted: the growth in production *is* continuing although more slowly than before. Shortfalls to plan have been recorded in the late 1970's but these have only amounted to 1–1½% of total production. The 1980 production total only represented a 61 percent shortfall in planned production.

On balance, however, the CIA has been correct in identifying some basic problems in the Soviet oil industry and it is important to dwell on these.

RESERVES

Any estimates of Soviet oil reserves offers a double challenge to a Westerner. Firstly, they have been state secrets since 1941 and sec-

[15] V. Aleksandrov, "International Aspects of Siberia's Development." *Far Eastern Affairs*. No. 4. 1979. pp. 63–86.

ondly, their estimation differs from that used in the West. In terms of ultimately recoverable reserves, even the Soviets themselves are guessing, such is the extent and inaccessibility of Soviet territory on and offshore where promising sedimentary basins can be found. It is therefore unfortunate that a major bone of contention concerning future Soviet oil production centers around the size of the proven resource base.

The 1977 CIA report created a sensation by announcing that, ". . . Soviet proven reserves are 4.1–4.8 billion tons, . . . there is no doubt that Russian proven reserves have been falling in recent years, and there is little chance that 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." [16] Two years later, the CIA again quoted Soviet proven reserves as 4.1–4.8 billion tons presumably signifying that the Soviets had managed to maintain additions to reserves in the interim.[17] However, as the table shows, all other estimates of Soviet proven oil reserves are considerably higher than those of the CIA. While most analysts find the estimation of the Swedish consultants PetroStudies far too high, there is also the feeling that the CIA is rather too pessimistic. It may therefore be significant that most estimates fall exactly in between the two extremes at around 8.2–10.3 billion tons.

TABLE 3.—WESTERN ESTIMATES OF SOVIET PROVED OIL RESERVES

[In billions of tons]

Source	Date estimated	Reserves
1. Oil & Gas Journal	Jan. 1, 1980	9.2
2. World Oil	End 1978	8.0
3. PetroStudies	End 1979	20.5
4. CIA	April 1977 (reiterated August 1979)	4.1–4.8
5. Dienes and Shabad	1979	10–10.9
6. Russell	1975	13.7–15.1

Note: For earlier estimates and a full discussion of Soviet and Western reserves terminology, see: David E. Levine "Oil and Natural Gas Resources of the Soviet Union and Methods of Their Estimation," in Project Interdependence: U.S. and World Energy Outlook Through 1990. CRS, Washington, D.C. November 1977, pp. 821–848.

Sources:
1. Dec. 31, 1979. p. 71.
2. Aug. 15, 1979. p. 64.
3. "Soviet Proved Oil Reserves, 1946–80," PetroStudies Consultants, Malmo, 1979.
4. "Prospects for Soviet Oil Production," April 1977, p. 3.; "The World Oil Market in the Years Ahead," August 1979. p.38.
5. "The Soviet Energy System: Resource Use and Policies," Leslie Dienes and Theodore Shabad, (John Wiley, 1979) p. 253.
6. "Energy as a Factor in Soviet Foreign Policy," J. L. Russell, Saxon House/RIIA, 1975, p. 40. (The estimate is for A+B+C1 or proven plus indicated reserves and must therefore be scaled down somewhat.)

There is general agreement that Soviet proven oil reserves, however measured, have been falling throughout the 1970's and also that nothing has been found in the western part of the country which could stem the decline in production in those regions. The argument seems to center around Western Siberia, where no other oil fields of the magnitude of Samotlor has been discovered but where, a U.S. Geological Survey report suggested that:

[16] *Prospects for Soviet Oil Production.* April 1977. p. 3.
[17] *The World Oil Market in the Years Ahead,* August 1979. p. 38.

. . . the overall geology of the West Siberian basin in addition to its tremendous size, the infancy of Soviet exploration with emphasis on development drilling, the size of reserves and the encouragement from recent drilling suggest that large oil and gas accumulations remain to be discovered.[18]

This indicates that there is no reason to suppose that further large accumulations will not be uncovered in the future, given the vastness of Soviet territory. What is at issue is the timing of these discoveries and whether they are made in Western Siberia, close to existing facilities, or whether it will be necessary to move significantly further east into Eastern Siberia, the Arctic and the Soviet Far East on and offshore. Not even the CIA disputes that there are abundant reserves in these territories, but any field discovered at this time would require at least one decade to bring into production, such are the conditions and the distances of these regions from the major consumption centers. The important question is whether the Soviets can bring smaller, more scattered fields into production at the required rate, while at the same time hoping for another large oil find, the size of Samotlor. With the clampdown on statistical reporting, it cannot be definitely stated that Soviet oil finds have been unsatisfactory. The Soviets would not feel the need to publicize oil discoveries at a time when they are attempting to persuade the population to make great sacrifices in terms of energy conservation. Nevertheless, if the Soviets could find at least one super giant field in addition to Samotlor in Western Siberia this would greatly help their oil effort and stand them in good stead for the 1980's.

PRODUCTION

Whatever the exact size of the Soviet proven oil reserve, Soviet officials have admitted that the reserve-to-production ratio has been declining over the past decade to the point where (in the estimation of one western expert) there may only be ten years of "fully recoverable proven reserves" at the disposal of the industry.[19] Part of the worst case argument is that production is already falling in all oil provinces other than Western Siberia and that because of the precarious reserve position, production in that region is on the point of peaking to be followed by a sharp decline.

Table 4 shows regional oil production statistics compiled by the CIA. (Soviet sources ceased to publish this material as part of the information clampdown in 1976.)

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[18] *Petroleum Geology of the West Siberian Basin and a Detailed Description of the Samotlor Oil Field.* U.S.G.S. Open File Report 77-871 1977.

[19] Leslie Dienes and Theodore Shabad, *The Soviet Energy System,* John Wiley 1979. p. 253.

TABLE 4.—GEOLOGICAL DISTRIBUTION OF SOVIET PETROLEUM PRODUCTION[1]

[In millions of tons a year]

	1970	1975	1978	1979	1980 plan	
					Original	Revised
R.S.F.S.R.	285	411	509.0	527.0	554.0	549
European Russia	227	221	207.0	197.0	192.0	188
Komi A.S.S.R.	7.6	11	17.0	19.0	25.0	21
North Caucasus	35	24	21.0	20.0	20.0	19
Volga	185	186	169.0	158.0	147.0	148
Urals	24	40	44.0	43.0	45.0	43
Siberia	33.8	151	257.0	286.0	318.0	318
West Siberia	31.4	148	254.0	283.0	315.0	315
Tyumen	28.0	143	246.0	273.0	305.0	303
Tomask	3.4	5	8.0	10.0	10.0	12
Sakhalin	2.4	2.5	3.0	3.0	3.0	3
Outside R.S.F.S.R.	68	80	63.0	59.0	86.0	57
Ukraine	13.9	12.8	9.3	8.3	8.6	7
Belorussia	4.2	8.0	4.0	3.0	9.0	3
Azerbaidzhan	20.2	17.2	15.0	14.0	19.7	13
Georgia	0.2	2.6	2.5	3.0	3.0	3
Kazakhstan	13.2	23.9	19.0	18.0	26.9	18
Turkmenia	14.5	15.6	12.0	11.0	16.0	11
Other Central Asia	2.3	2.1	1.5	1.0	2.0	1
Total	353	491	572.0	586.0	640.0	606

[1] Including natural gas liquids.

Soviet Geography: Review and Translation, 1980, No. 4.

Table 4 shows regional oil production statistics over the past decade. (Soviet sources ceased to publish this information on a regular basis as part of the information clampdown which commenced in 1976.)

The Table shows that aside from the Siberian regions, there were fractional production declines everywhere in the USSR and a sharp decline in the Volga region. This does not vitiate the Agency's main conclusion: that the older regions are generally in decline and that any major increase in production will have to come from Western Siberia, but it does cast doubt on the claim that sharp declines will immediately occur when production does eventually peak.

One further comment must be made concerning the production total in 1979. The winter of 1978/79 was extremely severe in the USSR with temperatures in Siberia such that until almost April, work in the oilfields was very severely restricted. This meant that the total oil extracted in the first quarter did not rise at all compared with the previous year, giving rise to speculation by the CIA that Soviet oil production had actually peaked. Subsequent monthly figures showed that this was not so, but that production had been severely held back by the weather. In part, this accounted for the poor result from the industry which could have perhaps produced 2–3 million tons more if conditions had been favorable. This in no way can explain the undoubtedly disappointing performance of the industry, about which Brezhnev was so eloquent at the Plenum in November of 1979, but it should be realized that the oil industry (like the whole of the Soviet economy) is vitally dependent upon fair weather conditions and that problems of this nature should not be attributed to lack of reserves or technology which have their own influence on production totals.

5. The Prospects to 1985

Table 5 contains nine different assessments of the Soviet oil balance in 1985—the longest time span over which predictions can be made with any degree of accuracy. Included are French, British and U.S. estimates from governments, companies and academic institutions. They are interesting in a number of respects: the U.S. Government predictions of production are well below the rest with the CIA high estimate 75 million T/Y below even the next most pessimistic forecast. The U.S. academics come next with a "low" scenario of just over 600 million T/Y while even as late as 1979, European academic sources with good Soviet connections were suggesting production levels up to and exceeding 700 million T/Y.

If Soviet production is difficult to estimate, the Soviet oil consumption is if anything, more difficult and the conceptual difficulties of making such a calculation are poorly appreciated. The figures that are generally quoted are "apparent" consumption; that is gross production minus a net trade figure. While these may be approximate as an arithmetical yardstick, they cannot answer the critical question which must be the level of internal oil usage which could be considered optimum at any particular time. In any case, such a judgment would be difficult on account of the Soviet allocative mechanism, the hallmark of which is shortage and mismatch.

TABLE 5.—SOVIET OIL BALANCE, 1985

[In millions of tons]

Production	Consumption	Imports	Exports	Net exports
1. 750 (650–670)	(580–580)			(100)
2. 655 (605)	545 (515)			110 (90)
3. 580 (600)	505			[1] 75
4. 612–713	467–536		144–157	
5.	525	50	150	100
6. 400–500			[2] 175–225	
		(50–100)		
7. 712.6 (630)	634.2 (603.5)			78.4 (26.6)
8. 680–700 [3]				
650–680				
9. 700 plus				
10. 620–645				

[1] To East Europe only.

[2] Soviet and East European imports; figures in parentheses are Soviet imports inferred by the author.

[3] Soviet estimates learned in discussions with oil industry officials.

Sources:

1. Jeremy Russell, The Times July 27, 1977. Figures in parentheses are Russell's 1979 estimates.
2. Leslie Dienes in: Leslie Dienes and Theodore Shabad, "The Soviet Energy System," (John Wiley: Washington, D.C. 1979), table 53, p. 252, figures in parentheses are low estimates.
3. Robert E. Ebel, "Soviet Oil in the 1980's" (Washington, D.C., September 1977). Figure in parentheses is indicated by a more recent paper by the same author "Energy Demand in the Soviet Bloc and the PRC," June 1979.
4. Hebert L. Sawyer, "The Soviet Energy Sector: Problems and Prospects." Harvard, January 1978 quoted in "Energy Projections—Oil, Natural Gas and Coal in the U.S.S.R. and Eastern Europe", Energy Policy, George W. Hoffman, pp. 232–241.
5. Harry G. Trend, "The Key to East European Economic Development." Radio Free Europe Research RAD Background Report 93 (Eastern Europe), May 12, 1978, cited in Hoffman loc cit.
6. CIA op cit.
7. "Situation et Perspectives du Bilan Energetique des Pays de L'est", Le Courier des Pays de L'Est, No. 216, March 1978. Median case cited, in parentheses is low case.
8. "La Production Petroliere Sovietique a L'Horizon 1985. Approche Regionale." Centre D'Etudes Prospectives et D'Informations Internationales, May 1979.
9. "Energy Supplies and Reserves in the ECE Region: Present Situation and Perspectives." Economic Commission for Europe, United Nations, New York 1979, p. 19.
10. Official Soviet 5-year plan target.

The problem when one calculates consumption as a residual, is that this method provides no possibility for prediction of future trends. For example, after the oil price rises of 1973/74, the rate of growth in apparent oil consumption fell from around 7% per annum to less than 5% and it was widely assumed in the West that the Kremlin had deliberately held back Soviet domestic consumption in order to take advantage of increased hard currency earnings by exporting more oil to the West. Equally, however, it could be that since Soviet economic growth rates had fallen in the first part of the 1970's, the Soviets had found themselves with more oil than needed to meet requirements than they had expected and were therefore, in a position to export more. To repeat, what we do not get from this picture is any idea of Soviet *needs* either in terms of priorities of the planners, or in terms of volumes necessary to sustain a certain level of economic growth.

Another approach is adopted by Leslie Dienes in his attempt to calculate the "energy intensiveness" of the Soviet economy, that is, the volume of energy needed to produce an equivalent volume of economic growth. Dienes demonstrates that in the quarter century up to 1975, Soviet energy consumption grew at a faster rate than Soviet GNP (however measured) and he argues that the energy intensiveness of the economy cannot decline to a level less than the rate of increase in GNP over the next decade.[20] Dienes is of course looking at aggregate energy consumption (in fact he uses the consumption of electric power in his example) in his calculation of energy intensiveness. Any attempt to calculate oil intensiveness in detail would require further disaggregation of some very questionable Soviet data. Nevertheless one can accept the broad generalization that the rate of growth of Soviet oil consumption cannot fall below that of GNP if severe economic dislocation is to be avoided.

Working from an apparent oil consumption in 1978 of 421 million tons and an average growth of Soviet GNP in the years 1978–85 of 3½% (the highest that any analyst is predicting for that period would bring 1985 oil consumption to around 535–540 million tons which coincides with the drift of the median forecasts in the table. If Soviet oil consumption should only grow at 3%—the consequence of a growth rate of only 2½% (the CIA is only predicting 2% growth rate for the USSR over the next five years)—the figure would be around 520 million tons.

TABLE 6.—SOVIET PRODUCTION AND CONSUMPTION OF OIL, 1985

[In millions of tons]

Production	Consumption	Surplus
1. 605	520	85
2. 650	550	100

Sources:
1. Production remains at 1900 level, consumption increases at 2½ percent p.a.
2. Production decreases modestly consumption increases 3½–4 percent p.a.

[20] *Dienes and Shabad*. op. cit.
Chapter 1. Nevertheless, others have argued that a decline in Soviet energy intensiveness has been evident since the late 1960's. See: William J. Kelly. "Effects of the Soviet Price Reform of 1967 on Energy Consumption." *Soviet Studies*. Vol. XXX. No. 3. July 1978. pp. 394–402.

Looking at the matrix above, production stabilised at the anticipated 1980 level is juxtaposed against slow growth in oil consumption (and GNP); increasing production is set against higher increases in consumption. The surplus varies from 85–100 million tons. The worst case here is arrived at by crossing the matrix (Production 1/Consumption 2) from left to right which assumes stable production and relatively high consumption, at which point the surplus falls to only just over 50 million tons.

Thus, in the worst case presented here, if it is accepted that Soviet oil production will do no worse than remain stable at the 1980 level; i.e., will not decline absolutely over the period 1980–85, then even with oil consumption at 4 percent (considerably more than the rate of growth of GNP which is anticipated) there would still be a surplus of 50 million tons for export.

6. Natural Gas

Partly because of the traditional preoccupation with oil and partly because of the slow recognition by the Soviet planners of the prospects for and implementation of development of the fuel, the prospects for natural gas have tended to be understated both within and without the Soviet Union. It was only at the end of the 1970's, with difficulties beginning to appear in the Soviet oil sector, that natural gas began to assure greater importance and to attract greater attention.

By any standards, the Soviets possess massive gas reserves. The proven total stands at some 28 trillion cubic metres—about a 70 year supply at current rates of production—more than one-third of the world's proven reserves. Ultimately, recoverable resources amounting to many times that figure have been identified offshore and are thought to lie in inaccessible regions of Siberia and the Far East. Unlike oil reserves, Soviet gas reserves are not classified as secret and their size is agreed (to within 2 trillion cubic metres) by all analysts including the CIA.

In the twenty-five years up to 1975, the Soviet gas industry proved a great disappointment to the planners who failed to see a single one of their production targets met by an industry woefully short of capital, technology and skilled labor. The center of production was (like the oil industry) moving into increasingly harsh physical terrain which called for different techniques of production and increasing sophistication in the means of pipeline transmission to bridge the ever widening gap between centers of production and consumption. It was with the transportation sector that the gas industry failed dismally in the 1960's and early 1970's. Even with the introduction of imported large diameter pipe and compressor stations, there were simply insufficient crews to lay and operate the transmission system in the difficult Arctic conditions. All thoughts of using volunteer "pioneer" or convict labor, which had to some extent occurred during the Stalin period, became ludicrous. The skill needed to lay and weld vast lengths of 56 inch pipe in temperatures below minus 20 degrees Celsius, demands a labor force of the highest caliber working with the highest quality precision equipment.

It is only in the late 1970's that some of these essentials have become available.

Despite the failure to meet production targets mentioned above, annual volume increases amounted to nearly 10 percent in the late 1960's and close to 8 percent in the following five years—an annual average of more than 15 billion cubic metres (BCM) per year. In the period since 1975 some remarkable progress has been made. Every plan target has been exceeded and annual increments of production have topped 27 BCM (an increase of more than 9 percent per annum). The 1979 plan target was revised upwards and even this was exceeded, production totalling 407 BCM—35 BCM greater than the previous year. The 1980 target of 435 BCM was fulfilled. The achievement of the gas industry in a five year plan when the economy as a whole, and the fuel sector in particular, has performed most disappointingly bears close attention.

It becomes evident that the gas industry will contribute very substantially to the Soviet and East European energy economy in the 1980's: developments being enhanced by the building of the Orenburg gas pipeline carrying 28 BCM of gas to the six East European members of CMEA. The USSR also exports gas to five West European countries (Federal Republic of Germany, France, Italy, Austria, Finland) and Yugoslavia. Total exports are believed to have exceeded 60 BCM in 1980.

Predictions of Soviet natural gas production in 1985 are somewhat thinner on the ground than those for oil. Most, however, see a fairly rapid increase in gas production and exports in the first part of the 1980's. It can be seen that the CIA estimates are well below all others, but not to such a great extent as the case of oil. (It may be of interest that in 1976 the CIA asserted that Soviet gas production would do well to reach 390 BCM—an underassessment of 45 BCM on the eventual result.[21] Nevertheless, natural gas development is dependent on rather different factors than oil concerning net reserves, which we have noted are abundant and proven; the crucial factor for gas is the equipment which the USSR imports from the West in the form of large diameter pipelines and compressor stations. The Soviets are utilizing these materials to full advantage and still not producing sufficient units domestically.

Also with natural gas (possibly even more than oil) the crucial question is one of *infrastructure.* The whole question of labor and infrastructure often merits only a passing reference to difficult conditions of work. There is little appreciation that these factors are of critical importance to the success of the Siberian energy effort. In the past, the Soviets have failed to give sufficient priority to the construction of an acceptable infrastructural base and the productivity and turnover of the labor force has reflected this lack.

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[21] *Soviet Economic Plans . . . .*

TABLE 7.—SOVIET NATURAL GAS BALANCE TO 1985

[In billions of cubic meters]

Production	Consumption	Imports	Exports
1. 605	550		[1] 55
2. 560–600		31	77. 8
3. 660	496–589	15	179. 5
4. 750 (680–645)	560		180
5. 647. 4 (597. 6)	481. 4(456. 5)		[1] 166(141. 1)
6. 600–640			

[1] Net exports.

Sources:
1. Dienes and Shabad, op cit, table 53, p. 252.
2. "CIA., U.S.S.R: Development of the Gas Industry," ER 78–10393, July 1978.
3. Sawyer in Hoffman., loc cit.
4. Economist Intelligence Unit, QER Special, No. 24. "Soviet Natural Gas to 1985," London 1975 (low estimate in parentheses).
5. Situation et Perspectives du Bilan Energetique des Pays de L'Est., loc cit (low estimates in parenthesis).
6. Official Soviet 5-year plan target.

The extremely high cost of operating in Siberian conditions combined with the sheer physical difficulty of creating an environment which workers find tolerable and are prepared to endure for long periods, even with the extra inducements which are offered, was drastically underestimated in the original development plan for gas deposits. The position of gas is more extreme than that of oil because the major deposits are located further north. Thus the cost of roads, construction and ancillary facilities for such fields as Medvezhe in Western Siberia and Vuktyl in Komi has taken up to 50% of the entire budget at the deposit.

The point of spending some time in the description of the gas industry is that after a decade of learning the conditions in Siberia, the vast development effort seems about to pay off. That is, the spurt in production can be attributed to the partial solution of some of the problems outlined above. If this observation is correct the results could be extremely significant. The Soviets have six giant fields each with reserves of over one trillion cubic meters within a relatively small area in Western Siberia. Given that the basic infrastructure has now been laid down at the Medvezhe and Urengoy deposits, there seems reason to think that the others could be brought in at accelerated rate. It should be remembered that the Soviets are relatively good at "gigantism" in economic organization, i.e., building giant complexes within a relatively small territorial area; it is the small piecemeal scattered development requiring a high degree of spatial coordination—such as the situation in the oil industry—that they are less capable of sustaining. It is therefore not impossible, given the resource base at their disposal, that Soviet natural gas development could rapidly take off if the pipelines and other transmission facilities can be constructed at the required rate. In the long term, this will mean vastly increased Soviet indigenous production of the necessary equipment and there are signs that this has been put in hand.

With these reservations in mind, a conservative estimate of production capabilities would see the average annual increase in production rising to around 35 BCM over the next five year period. Working from a 1980 production figure of 435 BCM, this would suggest a total of 610 BCM in 1985. This compares with a 5-year plan target of 600–640 BCM.

Soviet gas consumption is harder to forecast, largely due to uncertainties over contracted import volumes which have been disrupted, and at times ceased altogether, as a result of the revolutionary events in Iran and Afghanistan. Nevertheless, taking an overall approach to the CMEA fuel supply situation, it appears likely that natural gas consumption in both the Soviet Union and Eastern Europe will have to increase much faster than the growth of GNP (for reasons which will be discussed below). It seems reasonable to forecast that Soviet gas consumption will increase at about 6% per annum in the first part of the 1980's which would see a 1985 figure of around 520 BCM, perhaps boosted to 535 BCM by the imports from Iran and Afghanistan. Given a production figure of 610 BCM, this would give an export total of 90 BCM in the mid-1980's.[22]

7. Coal

The Soviet coal industry presents one of the major paradoxes of the Soviet energy sector and exposes some of the contradictions of the Soviet economy in general. On the one hand, reserves of around 240 billion tons with ultimately recoverable figures as high as 6 trillion tons; on the other, production levels which have, in the late 1970's virtually stagnated. In many ways, the most unexpected feature of the Soviet energy balance in the period 1976–80 has been that of the coal industry. After turning in an excellent performance in the previous five years, it has run up against serious problems of investment, equipment and deterioration of mine conditions, primarily associated with depth and thickness of seams.

A most interesting feature as regards western commentary, is that this development was entirely unexpected. While western analysts disagreed on the progress of oil and gas production, nobody appeared to doubt the fact that Soviet coal could manage the fairly modest target of increasing production by 20 million tons per year over the five year period. In the event, production rose by a total of just 13 million tons in the first two years of the plan and in 1979, totals actually fell to 719 million tons (which was less than the industry had produced in 1977) and fell again to 716 million tons in 1980.

Western commentators maintain that despite Soviet claims to produce the largest tonnage of coal in the world, the fact that most Soviet coal is of low calorific content and measured on a non-cleaned basis, substantially distorts Soviet reported figures. Less important than the issue of actual or claimed production is that the low quality of the large deposits of coal discovered east of the Urals drastically affects production prospects. The Kansk-Achinsk fields in Siberia and the Ekibastuz region of northern Kazakhstan contain abundant reserves of what is generally known in the U.S. as sub-bituminous coal with a heat content of around 4 million kilocalories per ton. Difficulties arise particularly with Kansk-Achinsk lignite which has a tendency to ignite spontaneously and thus cannot be transported long distances.[23]

As with all Soviet natural resources, the spatial imbalance between centers of consumption and production is the major problem. With

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[22] An Expanded version of this scenario can be found in: Jonathan P. Stern., *Soviet Natural Gas Development to 1990; The Implications for the CMEA and the West.* Lexington Books/D.C. Heath 1980.

[23] *Dienes and Shabad.* op. cit. Chapter 4. see also: *USSR: Coal Industry Problems and Prospects.* CIA. ER 80–10154. March 1980.

coal, the problem is possibly even more acute than other fuels. The western deposits, principally high quality coal from the Don basin, are beginning to deplete rapidly and it is clear that insufficient resources have been devoted to the newer regions which will need to take over the burden of production. In addition to this there is a major technological problem: it has long been realized that in the absence of a drastic relocation of Soviet industrial development east of the Urals, the poor quality lignites can only be fully utilized by means of long distance transmission of electricity. The Soviets have put in an immense research effort on these techniques meeting with some success as the line from Ekibastuz to Tambov (annual transmission capacity 40 billion KWH) suggests. Nevertheless, there is still a long way to go before the ultimate aim of construction of 2200 KV DC lines with annual transmission capacities of up to 100 billion KWH per year. Ultimately it is planned that a series of interlocking electricity grids will carry power many thousands of miles west and east, based on the abundant cheap coals burned in power stations located at the coalfields.

With respect to future production possibilities, it is important to recognize that the present development in the industry is not unprecedented. A look at the period since 1960 shows that both in the early and middle 1960's, coal production actually declined for one year before increasing again. The present leveling off in production totals is likely to be a more prolonged but still temporary phenomenon as the planners recognize the need to devote additional resources to the industry, but it has come at a bad time in that it limits the assistance that coal can render to the overall energy balance at a time when alternatives to oil are urgently being sought.

It would be unduly optimistic to expect the industry to greatly increase production over the next five years and an annual target of 800 million tons in 1985 (the upper limit of the 5-year plan target of 770–800 million tons) is the best that can be expected, despite the massive resource base of the country. Indeed, coal production (especially taking into account the decline in the calorific content of the coal) may very well miss the planned range by a significant margin. As a result of these developments, coal consumption is likely to grow extremely slowly. The small contracted volumes for the export of hard and coking coal to Japan, Eastern and Western Europe (offset by imports of hard coal from Poland), suggests a net export figure of around 30 million tons in 1985, leaving a consumption figure of 770 million tons—an increase of less than 1½% per annum over the five years.

TABLE 8.—SOVIET ENERGY BALANCE 1980–85 [1]

	1980			1985		
	Production	Consumption	Surplus	Production	Consumption	Surplus
Oil	603 (862.3)	473 (676.4)	130 (185.9)	650 (928.5) 605 (865.2)	550 (786.5) 520 (743.6)	100 (143.0) 85 (121.6)
Gas	435 (517.7)	380 (452.2)	55 (65.5)	610 (725.9)	535 (636.7)	75 (89.2)
Coal	716 (501.2)	691 (483.7)	25 (17.5)	800 (560.0)	770 (539.0)	30 (21.0)
Total	(1,881.2)	(1,612.3)	(268.9)	[2] (2,215.4) [3] (2,151.1)	[2] (1,962.2) [3] (1,919.3)	(253.2) (231.8)

[1] Oil and coal in million tons, gas in billion cubic meters. Figures in parentheses are standard fuel equivalent converted at: Oil, 1 ton=1.43 tonnage of standard fuel equivalent; gas, 1 billion cubic meter=1.19 tonnage of standard fuel equivalent; and coal, 1 ton=0.7 tonnage of standard fuel equivalent.
[2] High oil production.
[3] Low oil production.

The most notable feature of the 1980–85 scenario as portrayed in the table above, is the contraction of the Soviet energy surplus by 16–38 million tons of standard fuel (mtsf) during the period. In addition, it can be seen that the Soviet energy in 1985 will be made up of rather more natural gas and rather less oil than at the beginning of the decade. Another notable feature of the scenario is that production of the three major fuels is likely to increase only 2½ to 3% per annum over the five year period in the face of annual consumption increases of 3½ to 4%. Overall, it seems inevitable that the oil surplus will decrease while gas exports will increase considerably.

Thus the Soviets will begin to rely heavily on natural gas as the safety net to bridge the gap in energy consumption left by declining rates of growth in both oil and coal. As Dienes suggests, "Natural gas is the ace in the Soviet energy plans and provides a critical cushion for the uncertainties faced by planners with respect to other sources of supply." [24] Thus a vitally important factor for the domestic economy is the speed with which gas can be substituted for other fuels, principally oil. This relates not only to the availability of gas but the physical process of converting plants—mainly industrial furnaces and electric power stations.

The view put forward here is that up to 1985, in terms of domestic energy requirements, the Soviets will have little to worry about (the the issue of losing almost the entire surplus of hard currency oil exports is another matter) and will be able to maintain a net energy export of 230–250 mtsf (plus some electric power exports). However, this is only part of the story since the Soviets do not have only themselves to worry about; Soviet responsibilities in the energy sector to their allies in other countries, primarily Eastern Europe, make up the other half of the CMEA energy equation.

8. East European Energy in the 1980–85 Period

There is a marked tendency in the West to think and talk about Eastern Europe as one region united in its subservience to the USSR, in which all countries are alike. Although the inadequacy of this broad general approach is well documented, so far as energy is concerned it holds a measure of truth. Eastern Europe is taken here to indicate the six countries which are full CMEA members; Bulgaria, Romania, the German Democratic Republic (GDR), Czechoslovakia, Hungary and Poland. Yugoslavia, an associate member of CMEA, is excluded because it is not a country for which the USSR need feel any responsibility, i.e. it is not incumbent upon the USSR to make good any energy shortfalls that may occur in Yugoslavia.

Eastern Europe is an overwhelmingly energy deficient region, particularly as far as oil and gas are concerned and in this respect the relationship of these countries with the USSR is crucial. Nevertheless, although broad generalizations are possible so far as five countries are concerned, one country obviously stands out as the "sheikhdom" of the region.

ROMANIA

The Romanian oil industry dates back nearly a century to a time when the country enjoyed a preeminent position in Europe as regards

[24] *Dienes and Shabad*, p. 287.

oil production and all the related technological expertise. Although Romania can no longer claim technical superiority, it has for some time been the sole country in continental Europe (Albania excepted) to be self-sufficient in oil and gas. More notably for a CMEA member, Romania has vigorously asserted its independence from Moscow in foreign and domestic policy. In part, this has been possible because of the country's self-sufficiency in fuels. While Romania has made small amounts of oil and gas available to other CMEA members, Ceaucescu rejected a large scale relationship of this kind, indicating that the country would expand refinery capacity and, by adding imported Middle East crude to domestic production, sell refined products to the West for hard currency.

However, despite intensive exploration including greater drilling efforts offshore in the Black Sea, Romanian oil and gas reserves have depleted and production of both fuels peaked in 1976. This proved somewhat alarming to the leadership which had forecast continued increases in fuels production through 1980.

TABLE 9.—ROMANIAN OIL AND GAS BALANCE[1]

	1975	1976	1977	1978	1980	1985
Oil production	14.59	14.70	14.65	13.73	13.00	12.50
Oil imports	5.01	8.48	8.84	10.50	13.00	19.50
Natural gas production	29.7	32.9	27.5	29.0	25.9	25.4
Natural gas imports					1.5	1.5

[1] Oil in million tons, gas in billion cubic metres.

Sources: Oil and Gas Journal, Aug. 27, 1979. pp. 76–89; Park, p. 119.

Following the realization of declining indigenous production and urgent efforts to solicit oil from other sources, a serious falling out appears to have taken place between Romania and the rest of the CMEA countries. In August 1979, Romania suddenly announced that all East European tourists travelling through the country would be required to pay for their gasoline in foreign (i.e. hard) currency. Apart from being a bombshell, it was an order that the vast majority could not possibly comply with. Although the action was suspended after only a few days, it emerged (in the justificatory speeches) that Romania is now importing up to half its oil for hard currency or on hard currency terms and therefore the country cannot continue to sell to Eastern Europe on any other terms.[25]

Some interesting ancedotal evidence adds another dimension to this incident which occurred just after Ceaucescu visited Moscow. It seems entirely likely that Ceaucescu inquired after Soviet supplies of oil for Romania (the latter has been a marginal supplier of oil to the USSR) and was refused unless those supplies would be paid for in hard currency. Ceaucescu returned to Bucharest in a rage and immediately implemented the order on the basis that if his country had to pay hard currency for socialist oil, then everybody else could do the same. After the furor died down it was announced that the USSR would supply Romania with 350,000 tons of oil starting in late 1979, and this could be as an adjustment mechanism for other East European consumption of Romanian gasoline.

Nevertheless, Romania must continue to increase crude oil imports in order to fully utilize refinery capacity which will grow to around

[25] BBC Summary of World Broadcasts *SWB/EE/6189/C/1* August 9, 1979.

32 million tons in 1985. Hence at that time, Romania will need to import around two thirds of that amount, although domestic consumption will probably not exceed 20 million tons, the remainder being exported as refined products and petrochemicals.

In late 1979, there were conflicting reports of Romanian oil finds offshore in the Black Sea, with Ceaucescu laying stress on these sources in order to attain the goal of making the country independent of imported energy by 1990. Almost certainly this cannot be achieved as oil and gas production will do well to hold at current levels. Romania has reserves of coal (mainly poor quality lignite) which can be brought into the energy balance to a greater extent. Romania also has a nuclear program under way, although the first of four Canadian CANDU reactors has yet to start up. By 1990, 20% of the country's electricity is slated to come from nuclear power. Overall, Romania will slip into greater energy import dependence, especially with regard to oil where the country may be a net importer of up to 10 million tons per year by 1985.

The reason for treating the Romanian energy situation at some length is that in calculating the expected CMEA oil import totals, analysts often fail to distinguish between countries which the USSR has a responsibility to supply with oil and those which have pursued an independent course, such as Romania and Yugoslavia. The contract for the USSR to supply Romania with oil, concluded in late 1979, is unlikely to be the start of large scale oil flows between the two countries. (Romania's relationship with OPEC countries will be discussed below.) Soviet natural gas deliveries to Romania, which commenced in 1979, may, however, expand as indigenous production declines and it is in this fuel that Soviet-Romanian energy trade is likely to expand in the 1980's.

BULGARIA, HUNGARY, CZECHOSLOVAKIA, POLAND, GDR

While dealing with these countries in one section, it should still be realized that they enjoy very different levels of fuel endowment. Poland and the GDR are very significant coal producers to the point where Polish coal exports have enabled the country to be the only net energy exporter in Eastern Europe. However, all of these countries are poorly endowed with oil reserves; only Hungary will produce more than a million tons of oil in 1980 and production is, if anything, on the decline. The natural gas picture is somewhat brighter with the GDR, Poland and to a lesser extent Hungary hoping to increase production through 1985.

TABLE 10.—PRIMARY ENERGY PRODUCTION IN EASTERN EUROPE, 1978

	Coal (million tons)		Oil (million tons)	Natural gas (billion cubic meters)
	Hard[1]	Lignite[2]		
Bulgaria	0.3	25.5	0.1	(3)
Czechoslovakia	29.5	94.9	.1	1.2
German Democratic Republic	.2	253.5	.2	8.5
Hungary	2.8	22.6	2.2	7.3
Poland	192.7	41.0	.4	7.6
Total	225.5	437.5	3.0	24.6

[1] Includes anthracite.
[2] Includes brown coal.
[3] Negligible.

Source: Data from individual country reports.

The nuclear power program in Eastern Europe is impressive and ambitious and may be realized on the twin pillars of Czech and East German uranium production and imported reactors from the Soviet Union. Nevertheless, although nuclear power can take care of an increasing proportion of the electricity requirement of these countries, it cannot begin to make a dent in oil and gas requirements until the mid-1990's.

Concentrating on the trend in East European oil consumption, it can be seen that even in the post 1973 period, rates have been high by world standards (although not nearly as high as was foreseen in the early 1970's) but moderate when one considers that oil consumption increased an average of 15% per annum in the 1960's. The reason for this is partly that the approaching stringency with respect to Soviet oil deliveries did not appear so serious in 1975 when the 1976–80 quotas were agreed upon, and possibly more importantly, the late 1970's and early 1980's were to have represented the climax of the progressive changeover from solid fuels to oil and gas in the economies of all these countries—a process begun in the mid-1960's and long overdue in the industrial modernization of Eastern Europe.

Table 11 shows the growth of East European oil consumption since 1973 where the variations between the countries ranging from 4.5% per annum in the case of Bulgaria to 7.5% for Romania. Moreover, Hungary, with one of the largest indigenous oil production totals in the region, has by far the lowest rates of consumption. All of this suggests the merit of a detailed study of each country's endowments and patterns of fuel utilization. In the absence of space for such an analysis, it may be interesting to look briefly at rates of economic growth in Eastern Europe.

TABLE 11.—EAST EUROPEAN OIL CONSUMPTION 1973–79

[Thousands barrels per day crude oil equivalent][1]

	1973	1974	1977	1978	Percent 1973/78	1979[2]
Bulgaria	245	262	284	305	4.5	310
Czechoslovakia	300	314	383	385	5.1	387
German Democratic Republic	276	273	341	364	5.7	371
Hungary	178	187	228	246	6.7	244
Poland	266	260	359	371	6.9	389
Romania	274	263	348	393	7.5	410
Total[3]	1,539	1,559	1,943	2,064	6.1	2,111

[1] To convert to tons per year multiply by 50.
[2] Estimate.
[3] Totals may not add due to rounding.

Source: CIA, ER, IESR 79–013, Sept. 19, 1979.

TABLE 12.—GROWTH OF NET MATERIAL PRODUCT IN EASTERN EUROPE

[Average annual increase over previous year, percent]

	Bulgaria	Czecho-slovakia	German Democratic Republic	Poland	Romania	Hungary
1973	8.1	5.2	5.6	10.8	11.1	7.4
1974	7.4	5.9	6.4	10.4	12.3	6.9
1975	8.7	6.2	4.9	9.0	10.3	5.4
1976	6.5	3.7	3.6	7.1	10.5	3.0
1977	6.3	4.2	5.2	5.6	8.6	7.6
1978	6.0	4.0	4.0	2.8	7.6	4.0
1973–78	7.2	4.9	5.0	7.6	10.1	5.7
1979 [1]		2.7	4.0	−2.0	6.2	1.5
1980 (plan)	5.7	3.7	4.8	1.4–1.8	9.0–10.0	3.0–3.5

[1] 1979–80 figures are estimates.

Sources: DIW Bulletin, June/July 1979; RGW in Zahlen CMEA Data 1978.

It is immediately evident that East European growth rates have trailed off towards the end of the decade and are expected to fall further in the early 1980's. To a certain extent, the recent low growth rates must reflect resources constraints, particularly with regard to fuels. It seems likely however, that with the anticipated further decline in economic growth will come further decreases in demand for fuels. Comparing rates of economic growth with rates of increase in oil consumption over the 1973–79 period, only Hungary experienced an increase in oil consumption which greatly exceeded the rate of economic growth. It now seems to be generally accepted that with the exception of Romania and perhaps Bulgaria, no East European country will enjoy an economic growth rate of more than 5% in the early 1980's and most will be considerably less. On past trends therefore, the rate of growth in oil consumption might be expected to fall considerably below 5% in the early 1980's.

The overwhelming reliance of the five countries on Soviet oil deliveries and their inability to generate sufficient hard currency to purchase oil on the world market, severely limits the options open to them with respect to their energy requirements. The Soviets will be charging progressively higher (soft currency) prices for their oil and probably increasing the proportion of oil deliveries for which the East Europeans need to pay in hard currency (or the equivalent in goods). With the parlous economic state of East European countries and their already considerable hard currency debt, there must be real doubts as to whether these countries have the capacity to pay for increased oil deliveries.[26] Some American commentaries have suggested that the Soviets will step into the breach and purchase oil on the world market

[26] See also the discussion in: John R. Haberstroh., "Eastern Europe: Growing Energy Problems". *East Europe Economies Post-Helsinki.* Joint Economic Committee. Washington, D.C. August 25, 1977. pp. 379–395.
For data on the debt problem see: *Estimating Soviet and East European Hard Currency Debt,* CIA, ED 80–10327, June 1980.

for Eastern Europe using its own hard currency. This situation is not considered likely by West European commenators who have consulted East Europeans on this subject; this writer shares their skepticism.

As mentioned above, Soviet oil deliveries to other CMEA countries will be pegged at the 1980 level over the following five years. This may not mean that Moscow will absolutely refuse to export more oil to its allies, but the latter would certainly have to pay at rates and in currencies similar to what the Soviets would receive for sales on the world market. Therefore, although the aggregate energy balance of Eastern Europe will be boosted by deliveries of Soviet gas and electricity, oil shortages will be a big problem and the aim will be to restrict oil consumption to the maximum possible extent.

Aside from the usual problems and uncertainties of forecasting, any attempt to predict East European oil requirements in 1985 must take into account a range of scenarios from an optimum situation in which oil supplies are unconstrained in Eastern Europe to a minimum senario in which oil supplies are only just sufficient to maintain economic growth at acceptable levels. Given the restrictions on oil which will be come increasingly severe throughout the 1980's, it is likely that the major task of East European Governments will be to determine the minimum level of essential supplies, or even perhaps to learn to cope at below what is considered to be the minimum.

In this situation, what is attempted here is to suggest the level of East European oil consumption in an "optimum" situation, i.e. where oil consumption is allowed to grow during 1980–85 at the same rate as been experienced in 1973–78, and contrast this with an anticipated level of consumption based on the rate of economic growth which the various East European Governments have planned for the early 1980's.

It may be objected that this is "putting the cart before the horse", and that the proper procedure is to determine levels of oil availability and then calculate the level of economic growth that these will allow. But what is being attempted here is to show that even if East European economies were to grow at rates reflecting those of the mid-1970's with increases in oil consumption reflecting those of the mid-1970's the result would still not warrant the importation of the volumes of oil predicted in the pessimistic forecasts of the CMEA energy situation.

TABLE 13.—EAST EUROPEAN OIL CONSUMPTION IN 1985

	Poland	Bulgaria	Romania	Czecho-slovakia	German Democratic Republic	Hungary
Average annual increase in net material product 1973–78 (percent)	7.6	7.2	10.1	4.9	5.0	5.7
Average annual increase in oil consumption 1973–78 (percent)	5.0	3.5	6.1	5.9	5.5	9.6
Average anticipated increase in net material product 1980–85 (percent)	2.0	6.0	9.5	3.7	4.9	3.0
Oil consumption in 1985 (barrels per day):						
1[1]	478.4	369.0	575.2	597.5	523.7	503.4
2[2]	377.3	356.7	400.0	544.3	520.2	375.4
	(1.5)	(3.0)		(4.5)	(5.4)	(5.1)

[1] Total equals 3,047.2 mm bbl/d which equals 152,400,000 tons.
[2] Total equals 2,573.9 mm bbl/d which equals 128,700,000 tons.

The first two lines of table 13 contrast the rate of increase in the growth of Net Material Product (NMP) with the rate of increase

in oil consumption, showing that in Czechoslovakia, the GDR and especially Hungary, oil consumption has increased faster than economic growth. The third line then anticipates a rate of NMP growth for 1981–85 in line with what the Governments of the respective countries have indicated is "planned" or anticipated during that period. Oil consumption scenarios are then presented for an optimum situation: where the rate of growth in oil consumption is extrapolated using the same annual average increase as was experienced in 1973–78; and in an "anticipated" situation: where the rate of growth is extrapolated using a weighted average figure (in parentheses) which bears a relationship to the anticipated increase in NMP. For example, looking at Bulgaria, oil consumption increased 4.5% per annum during 1973–78 against an increase in NMP of 7.2% per annum. For 1980–85, the increase in NMP has been forecast at 6% per annum and I have therefore suggested an increase in oil consumption of 3.8% per annum. The figure 396.0 mbd (19.8 million tons) therefore represents Bulgarian oil consumption extrapolated at 3.8% from 1978–85.

Romania has not been estimated in this way because reports from Bucharest have suggested a carefully planned oil policy encompassing imported and exported crude in order to fully utilize planned refinery capacity (see above). In this plan oil consumption is planned to rise just 1 million tons over the years 1980–85, reflecting the determination of the Romanian Government to bring other fuels—principally coal and nuclear power—into the balance to a much greater extent. If this effort proves unsuccessful, it may be necessary for oil consumption to rise. Performing the same calculation on Romanian oil consumption as for the other countries suggests that the level would have to rise to more than 30 million tons in 1985 compared with the planned 20 million tons for that year.

What emerges from this exercise is that if the CMEA countries of Eastern Europe were to continue to expand oil consumption in the coming period at the same rate as the previous five year period, their requirements would be around 155 million tons in 1985. More likely, given the rate of growth anticipated over the next five years, their consumption will be around 128 million tons.

TABLE 14.—NET CMEA OIL EXPORTS (IMPORTS) IN 1985

[In million tons]

	U.S.S.R.	Romania	Other Eastern Europe [1]	Other CMEA [2]	Total CMEA
Net export (import):					
High	100	(20)	(119)	(20)	(59)
Low	85	(7)	(105)	(15)	(42)

[1] Poland, Hungary, Czechoslovakia, German Democratic Republic, Bulgaria. (Production of 3,000,000 tons allowed for.)
[2] Cuba, Mongolia, Vietnam.

Table 14 offers estimates of the CMEA oil deficit in 1985 and finds that those countries will be looking to the world oil market for 40–60 million tons at that time. (Those who generally include Yugoslavia in their appraisal of CMEA, since the country is an associate member of the organization, may wish to add 15–20 million tons to that estimate.) This figure, however, represents the strain that these countries will exert on world oil supplies. Such an estimate must be distinguished

from the responsibility of the USSR to provide its CMEA partners with oil and this is why Romania has been disaggregated from the East European totals (and Yugoslavia is not included). In order to determine the magnitude of that responsibility, the Romanian deficit must be subtracted from the final totals.

Thus in the Soviet "high" case (where oil production continues to increase slowly) and the East European continue to increase oil consumption at the levels of the mid-1970's, the deficit is just under 60 million tons. In the "low" scenario where Soviet oil production remains stable and East European countries reduce consumption along with reduced economic growth, the overall deficit is cut to 42 million tons.

Those who take a pessimistic view of the CMEA energy situation may prefer to consider a case where Soviet production remains stable and consumption continues to rise throughout the bloc giving a CMEA deficit of 75 million tons (90 million including Yugoslavia). Far more likely in the view of this author is the opposite scenario of reduced East European consumption and slowly rising Soviet production, resulting in a CMEA deficit of 27 million tons (which reduces to 20 million tons if we consider only the region that the Soviet Union has a responsibility to supply, i.e. the five countries minus Romania).

Indeed, the general consensus would probably be that I have been unduly optimistic in adhering to East European forecasts of their own economic growth over the next five years. Most analysts would probably be forecasting annual economic growth rates not above 3% per annum for Poland, Czechoslovakia, GDR and Hungary, while Bulgaria is unlikely to average more than 4% and Romania will do well to manage 6% per annum. Thus it would not be difficult to imagine a situation where East European oil consumption barely rises from present levels over the next five years, partly because of reduced economic growth (and a determination to substitute other fuels) and partly on account of Soviet announcements that oil deliveries to Eastern Europe will be pegged at 1980 levels.

Following on from this, if we consider the volumes of crude oil that Eastern Europe might be able to import from the Middle East it becomes clear that despite their difficulties in negotiating for oil, there are further opportunities for alleviating the anticipated CMEA oil shortage.

TABLE 15.—EAST EUROPEAN IMPORTS OF CRUDE OIL FROM THE MIDDLE EAST

[In millions of tons]

	1973	1978
Bulgaria	2.14	1.34
Czechoslovakia	1.13	.31
German Democratic Republic [1]	1.27	1.90
Poland		1.93
Hungary	.79	1.46
Romania [2]	3.60	12.42
Total	8.93	19.36

[1] Excluding reexports from West Germany.
[2] Estimates.

Source: Drawn from foreign trade and statistical yearbooks of CMEA countries.

CONCLUSION

If Soviet oil production levels off at the 1980 figure; if East European consumption continues to grow at past rates; if oil producing countries refuse to supply a drop of oil to Eastern Europe (and other CMEA countries) on concessionary terms in 1985; the maximum deficit for the Soviet-supplied countries is 54 million tons (90 million tons including Romanian and Yugoslavia). In the event, it is likely that all those conditions are too pessimistic, i.e. that: Soviet oil production will rise slowly (and other fuels, notably gas, will fill the breach to some extent); that East European consumption will barely increase in the 1980–85 period; that East European imports of oil from the Middle East will rise slowly to around 20–25 million tons. This would leave the USSR with a small surplus of oil to export for hard currency.

In two important senses, all calculations of CMEA oil imports are spurious. Firstly, East European countries will attempt to increase oil imports from the Middle East on soft currency/barter terms to the maximum possible extent. To the extent that this policy meets with success, it relieves the USSR of the need to supply those quantities of oil. Although it is difficult to be optimistic about the capacity of the East Europeans to arrange such deals, the possibility should be borne in mind.

Second and more important, where there is no money to buy oil, there can be no oil purchases. This simple fact often eludes analysts who make calculations of production and consumption assuming the difference will be bridged by imports. In communist countries this is simply not the case; the deficit is in Eastern Europe which does not have the wherewithal to enter the world oil market. The question then arises that without such oil, economic growth rates may fall to an unacceptable level, provoking social unrest, particularly in East European countries. This may be the single most important aspect of the energy problem in the CMEA region and the continuing economic/political/strategic relationship of the USSR vis a vis Eastern Europe in the 1980's, particularly in view of the situation in Poland in early 1981.

Perhaps equally important is the fact that the above scenario sees no way in which the Soviets can maintain any sizable oil exports to the hard currency area in 1985. Since oil earnings constituted more than half of total Soviet hard currency earnings in the late 1970's, this is an extremely important development. Nevertheless with the rapid increase in world oil prices in 1979/80, the Soviets do not need to sell nearly as much oil to maintain the same hard currency earnings. For instance, at the beginning of 1980 it was reported that the Soviets had raised their prices to $32.50 per barrel. At that price, the Soviets would only need to sell 25 million tons—about half of their 1978 sales—to maintain their hard currency earnings at the same level as the previous year. Much will depend on Soviet needs for western technology and goods, compared with what western countries are prepared to make available, but with the rise in oil prices apparently set to continue, the Kremlin could possibly evolve a policy of making a small (and decreasing) quantity of oil available to earn a guaranteed volume of hard currency.

The final point in this section therefore is that, up to 1985 at least, there does not seem to be any pressing need for the Soviet Union to invade the Middle East oil producers because of massive oil shortages. This is not to say that the Soviets would not wish to develop close relations with OPEC producers and having done so would not press to obtain oil for itself and/or its East European partners on concessionary terms. Nevertheless, the overall impression is that the CMEA energy situation to 1985, while tight, remains manageable.

B. Soviet and East European Energy Beyond 1985

For most industrialized countries it is possible to predict with some degree of confidence the potential of energy production for a decade into the future. This is possible because the energy resource base is fairly well mapped out and data are fairly accessible. These generalizations do not hold true for the USSR.

The regions of the Soviet Union west of the Ural mountains are fairly well explored onshore, to the point where it is unlikely that large accumulations of oil and gas remain to be discovered. The only regions east of the Urals which have been explored to even a moderate degree are Central Asia and Western Siberia. Of the more distant regions further east, a recent study suggests that oil exploration wells in Eastern Siberia number one per 3225 square kilometers.[27] The Soviet Far East has received even less attention.

Another vast potential hydrocarbon bearing area, where the Soviets have only scratched the surface is offshore, particularly in the Barents, Kara and other Arctic Seas adjoining Siberia. No leading authority doubts that the Soviets have a good deal more oil and gas to find on their territory, only their ability to locate and extract the hydrocarbons at a sufficiently fast pace.

Although the Soviets would be pleased to find any hydrocarbons on their territory it is oil that at present would be the most welcome discovery. The natural gas resource base is such that the absence of a major find in the next five or even ten years would not be disturbing to production prospects. However, the Soviets could definitely use a major oil find, preferably in an accessible region. The possibility should not be neglected that they have in fact made such a major find and decided not to publish the details; however, the likelihood is that they have not done so and that worries have definitely set in about oil reserves and the ability to support rising production through the 1980's.

Given the expanse of promising sedimentary territory at their disposal the Soviets could be said to have been desperately unlucky (or incompetent) to have failed to make a major oil find in the past five years. That they have apparently failed to do so, in no way suggests that such an event is impossible in the future, in fact quite the reverse as one analyst pointed out in 1977, "The potential for new discoveries in Western Siberia is far from exhausted and it would be foolish to predict that no more major finds are in the offing. One could come tomorrow and then all bets would be off." [28]

[27] *La Production Petroliere Sovietque a L'Horizon 1985. Approche Regionale.* Centre D'Etudes Prospectives et D'Informations Internationales. May 1979. Annex 1. p. 5.
[28] Robert E. Ebel., *Soviet Oil in the 1980's.*, September 1977. p. 8.

The pessimists on Soviet oil prospects will say that even if a field were to be discovered tomorrow, it would make no difference to production prospects in the short run. This is absolutely true, but one should point out that the short run lasts only some seven or eight years and possibly less if a large field were to be discovered reasonably close to an already producing area. Thus it is not yet possible to forecast Soviet oil production in 1990, even if the Soviets were only to locate oil in remote regions poorly connected to current supply routes and far from centers of consumption. Anyone who doubts this should ask themselves whether in 1970, when Western Siberia produced 31.4 million tons of oil and 4 BCM of gas, they could have imagined those figures to have expanded to 315 million tons and 156 BCM in 1980. Although it is true that the reserve base for oil was more favorable in 1970 (but we do not know how much more favourable), few would have foreseen an expansion of that magnitude given the nature of the terrain and remoteness of Western Siberia. Having made this progress within a decade, there is every reason to believe that a similar massive effort, albeit yielding much smaller production gains could be mounted in the 1980's.

The failure of western analysts to predict major developments in the Soviet energy balance even over short periods has been alluded to. Europeans were generally too optimistic about oil production, Americans too pessimistic about gas, while nobody foresaw the problems which were to bring coal production to a halt. What is also interesting is that, if one accepts that plan targets are intended to reflect reality, the Soviets are no better at forecasting than the West. This can be illustrated with reference to the 1976–80 period when the oil production target was originally given in terms of the range 620–640 million tons. Soon afterwards, General Secretary Brezhnev made a particular point of announcing the target as a firm 640 million tons at a time when it was already clear that the actual figure would be nearer the lower end of the range (and had subsequently proved to be much below this). Similarly for coal, the 1980 target was put at 800–810 million tons, subsequently revised to 805 million tons, apparently without consideration of the fact that production would peak and decline by 1979.

In the case of gas, twenty years of unrealistically bullish plans were followed by a moderate set of targets at just the time when bullishness would have been warranted—targets have been overfulfilled, often by considerable amounts.

These examples are intended to illustrate the proposition that unless the planners are playing some diabolically tricky game, (the significance of which has escaped everybody) they have no very clear idea of how much fuel can be produced in the Soviet Union even five years hence, let alone one or two decades into the future. Yet, the planners are the people with the best possible information at their disposal. It is in this light that any attempt to make production forecasts beyond 1985 should be viewed.

The first point to be made about Soviet energy in the period 1985–2000 is that it will be an overwhelmingly fossil fuel future. Very little emphasis has been placed on "alternative" energies as baseload supplies. The nuclear program, while substantial in the late 1980's and

1990's is still unlikely to provide more than 10% of total Soviet energy consumption at the end of the century.

The continued emphasis on fossil fuels is likely to be of great benefit to the Soviets in that, although these will become more expensive to extract, they are unlikely to reach the prices being paid by the West for new sources of energy. In addition, the Soviets may profit by the experience of the West as it makes inevitable errors in its adjustment to the post-oil era.

For the Soviet oil, gas and coal industries, two basic features of the problems over the next two decades will be similar to those being experienced at present, but of greater magnitude. The territory into which the industry must move will be that much more inhospitable, demanding a greater capacity to cope in very extreme temperatures in ever-increasing depths of frozen ground. The distances between the source of the fuels and the regions in which they are consumed is likely to increase, demanding more and more sophisticated means of transmission.

As regards their shares in the energy production balance: after 1980, the share of oil will decline slowly over the first part of the decade and then more quickly as production levels off (and possibly falls) after 1985. In the 1990's, the share of oil in the energy balance may fall sharply in the event of a failure to discover and exploit additional reserves of the fuel.

Natural gas is the fuel that bears watching most closely, not simply because the industry has suddenly begun to perform remarkably well, but also because of the vast resource base which is already established and can be exploited with technology available to the Soviets at this time. In the short term, gas will be the major fuel to take up the slack in the event of serious oil problems and will continue to increase its share in the energy balance throughout the remainder of the century.

The coal situation is in a way the most difficult to judge. Resources are so vast that an all-coal energy economy was canvassed at one time. The current problems have taken everybody by surprise but they are not without solution and production can begin to increase, albeit slowly, after the necessary investments have been made. Large scale exploitation of coal (which Soviet reserves could easily support) awaits a technological breakthrough either in the processing of the fuel or in long distance electricity transmission. The development of an interlocking system of electricity grids in the Soviet republics is most interesting in this respect.

Information about the civilian nuclear power program is sparse. The nuclear industry has suffered from many teething troubles principally concerning equipment and technology, but its basic problem has been a lack of priority accorded it in the face of competing sectors, i.e. nuclear weapons programs and fossil fuel energy resources. The Soviets commenced their nuclear energy program at a rather gentle pace (possibly influenced by the bad accident in 1957) because they did not need to do otherwise, i.e. they could see their fossil fuel future stretching out in front of them. This may now change as fossil fuel prospects become more uncertain and the sudden stress on nuclear power in the literature tends to confirm this. Nevertheless, nuclear power cannot become really important until the 1990's and probably not until the next century, although it will drastically increase its share in the energy balance.

For those who feel cheated without numbers, however spurious, the Soviet energy situation to the end of the century might be characterized by the following:

Oil.—Production of 625–650 million tons in 1985 levelling off and declining unless fairly substantial reserves are discovered in the near future. Thereafter, if discovery rates do not improve, a CIA-type scenario could set in with production falling as low as 550 million tons in 1990 levelling or falling as low as 450 million tons by the end of the century. It is inconceivable to this writer, however, that reserves of some magnitude will not be discovered in the vast expanses of Soviet territority previously unexplored, particularly if exploration is stepped up offshore.

Gas.—Production to rise steadily throughout the remainder of the century (and conceivably thereafter): 610 BCM in 1985, 750 in 1990, 1000 BCM in 2000. To those who think that this is a phenomenal expansion in production (which it is), it should be pointed out that the proven reserve base *already established* could support this type of expansion and continue to supply at the level of 1000 BCM for more than ten years into the next century without the discovery of another cubic meter of gas.

Coal.—Production is likely to rise from less than 800 million tons in 1985 to about 880 million by 1990, thereafter levels will depend on the priority given to the fuel in terms of investment and the question of technology in conversion of large deposits into usable forms of energy. Production may not rise above 900 million tons by the end of the century, but there are possibilities for the industry to produce 1000 million tons at that time.

Nuclear power.—Targets are unlikely to be met through the 1980's for the same reasons as in the 1970's, but the magnitude of the underfulfillment will not be as great. No more than 50 billion kWh can be expected in 1985 with the total rising to 90 billion kWh in 1990. Thereafter, depending on the progress of the breeder program and the imperatives caused by possible shortfalls in other fuel targets, it seems feasible that nuclear power production could multiply three times in the 1990's to nearly 300 billion kWh, but 200 billion kWh would seem a more achievable target.

TABLE 16.—SOVIET ENERGY PRODUCTION 1985–2000—LOW SCENARIO

[Natural units[1] (NU) and percentages]

	1985		1990		2000			
					A		B	
	NU	Percent	NU	Percent	NU	Percent	NU	Percent
Oil	605	38.2	550	31.5	550	27.2	450	22.2
Gas	610	32.1	780	37.2	1,000	41.2	1,000	41.2
Coal	800	24.7	880	24.6	900	21.8	900	21.8
Nuclear power	50	2.7	90	4.7	180	7.7	298	12.7
Other[1]	52	2.3	57	2.3	60	2.1	60	2.1
Total[2]	2,268	100.0	2,497	100.0	2,887	100.0	2,887	100.0

[1] Natural units: Oil and coal in million tons, gas in billion cubic meters, nuclear in billion kilowatt-hours.
[2] Million tons of standard fuel equivalent.

The table above shows a conservative estimate of Soviet energy production through the year 2000. It is conservative because it assumes that the search for oil deposits will be unsuccessful and that Soviet oil

production will peak in or around 1980 holding at that level until 1985 and then declining. Production is then assumed to fall 50 million tons in the following five years and do no better than to hold at the 1990 level (scenario A), at worst (scenario B) suffering a sharp decline of 100 million tons by the year 2000.

Gas is expected to develop strongly throughout the period and nuclear power will become a major contributor to the energy balance, although not reflecting the level at which the planners have indicated they would like to see the industry in 1990. A possible additional role for nuclear power is suggested in scenario B where it would take up the slack, if oil production were to fall catastrophically in the 1990's. Coal is conservatively estimated to increase production by no more than 100 million tons over a decade and a half, reflecting the judgement that the industry will fail to make the required breakthroughs in either processing or electricity transmission. No other fuel is judged as being of significance through the remainder of this century.

This conservative scenario brings out an important feature of the Soviet energy balance through the end of the century: the critical period for energy supplies will not be the period up to 1985, where fuels production can increase at somewhere near 3% per annum; nor is the decade of 1990–2000 looking too difficult where the totals suggest that production could increase by the same amount—3% annually. The really difficult stage in Soviet energy production over the next two decades will be the 1985–1990 period where production may not be able to increase by more than 1–1½% per annum.

The problem in the 1985–90 period is that *if* oil production falls rapidly, none of the other fuels could fill the gap at a fast enough rate, although substitution possibilities, primarily with gas, would allow some alleviation of the problem, such a development would undoubtedly constrain economic growth rates in the country as a whole.

In the final decade of the century, falling oil production would be easier to cope with because the development of fuels other than oil—gas and nuclear—should be farther along and, crucially, because the planners will have sufficient time to allocate investments in such a way that the deficit is made up. This is the critical difference between the A and B scenarios for the year 2000: if in 1985 the planners find themselves short of both current oil production and potential reserves they will clearly see the need to accelerate one of the other fuel options. Scenario B may be somewhat bullish on nuclear in that it suggests that the source will make up the entire oil deficit (whereas coal will also have to take some of the strain), but this reflects the view that nuclear will appear the better investment to the planners. But any of the domestic fuel options will seem a better investment than importing astronomically priced foreign oil.

It is in the final decade of this century that the potential fossil fuel resource base and unconstrained nuclear option will come into their own, as the totality of an energy policy can be developed. If one link, i.e., oil, fails, then something else can be brought in to take its place, provided the failure is not too catastrophic and sufficient investment time is allotted. It is this situation that the Soviets cannot hope to reach before 1990.

If this analysis has seemed somewhat contrived, it is because this

author does not believe that the Soviets will be encountering this degree of trouble in the energy sector. Accordingly, a more likely scenario is presented below.

TABLE 17.—SOVIET ENERGY PRODUCTION 1985–2000—AUTHOR'S SCENARIO

[Natural units[1] (NU) and percentages]

	1985		1990		2000	
	NU	Percent	NU	Percent	NU	Percent
Oil	650	40.0	650	35.2	650	30.0
Gas	610	31.2	780	35.2	1,000	38.4
Coal	800	24.0	880	23.3	1,000	22.5
Nuclear	50	2.6	90	4.2	180	7.1
Other	52	2.7	57	2.2	60	1.9
Total[2]	2,328	100.0	2,641	100.0	3,100	100.0

[1] Natural units: Oil and coal in million tons, gas in billion cubic meters, nuclear in billion kilowatt-hours.
[2] Million tons standard fuel equivalent.

This scenario differs crucially from the previous one in that oil production is seen to rise to 650 million tons in 1985 and hold there for the remainder of the century. Coal is also anticipated to rise at a more rapid rate, while nuclear power is thought to play a lesser role. This suggests that although the annual rate of growth in energy production will fall below 3% during 1985–90 it will not be drastically reduced and will recover in the final decade of the century to rise at around 3.2% per annum.

1. East European Energy After 1985

As has been suggested, Eastern Europe's energy alternatives are extremely constrained and will become more rather than less so, after 1985. For these countries with few indigenous energy resources and an absence of currency to purchase such supplies on world markets, there are only two options over the next twenty years: depend increasingly on Soviet supplies, or develop new energy sources, primarily nuclear power.

It has been suggested that in the worst of all cases the five East European countries for which the USSR has direct energy responsibility (and Cuba) will be requiring 55 million T/Y of oil from non-Soviet sources by 1985. If acceptable rates of economic growth are to be maintained a more likely estimate of these requirements is thought to be 20–30 million T/Y of oil.

Eastern Europe will try desperately to offset these trends by accelerating its nuclear power program (more than tenfold in the 1980's), making greater efforts to develop indigenous coal and practising all and any kind of conservation measures. Nevertheless, economic growth rates have already been, and will increasingly be, affected by energy constraints. The future may therefore revolve around the ability of Eastern Europe to import oil on world markets. In the absence of such imports, reduced economic growth rates cannot be avoided. Thus the question of future Soviet oil deliveries becomes critical and may increasingly underlie economic relations between the USSR and its CMEA partners.

Those who have observed that the USSR will not wish to lose eco-

nomic leverage over CMEA countries by scaling down oil deliveries are missing the point. In a very constrained oil situation throughout the bloc, the question for the Soviets may be that of identifying the minimum level of oil (and other energy) exports necessary to maintain the East European economic growth (and hence political status quo), particularly if the greatly reduced rates of growth currently being experienced give rise to popular discontent. This in turn requires a political decision on the part of the Soviet leadership as regards the trade-off of Soviet domestic oil requirements. Put bluntly, it is one thing to sacrifice hard currency earnings in or to fulfill fraternal socialist obligations (or more realistically, to maintain economic and political hegemony over the bloc), it may be quite another to do so at the expense of Soviet economic growth.

This is not to say that the Soviets will leave Eastern Europe in the energy lurch; politically and strategically they simply could not afford to do so. It does mean however, that other formulas will have to be worked out in terms of: alternative fuels; alternative methods of payment; alternative sources of fuel (i.e. outside the CMEA).

As far as alternatives to oil are concerned, we have mentioned the near term importance of natural gas deliveries from the USSR to Eastern Europe which will increase nearly threefold from around 33 BCM (including Romania and Yugoslavia) in 1980, to just under 100 BCM in 1990.[29] Another important alternative, but only in the medium to long term, will be nuclear power.

As regards payment to the Soviet Union for fuels, these developments will bind the CMEA economic links even tighter by increasing East European indebtedness to the USSR. The price of Soviet fuels to Eastern Europe will continue to rise (albeit at a slower rate than world prices) and the fraction of those fuel deliveries which have to be paid for in hard currency (or equivalent goods) will increase.

This will adversely affect the capacity of East European countries to maintain or increase trade with the West, further limiting hard currency earning potential. Much will depend on the degree of success that East European countries meet in procuring oil from OPEC countries on non-hard currency terms. The relationship of Eastern Europe with OPEC and the future possibilities for oil trade will be discussed in the following section.

2. Soviet and East European Energy Over the Next 20 Years

Simplified to its most basic level, the energy situation of the CMEA countries over the next two decades rests on two critical developments: the short and medium term future of Soviet oil production and the medium and long term development of nuclear power throughout the bloc.

Lack of information on both these questions precludes any definite statement beyond the immediate future. The key question as far as Soviet oil production is concerned is the magnitude of the reserves which have been discovered in the past five years and will be discovered in the early 1980's. For nuclear energy the important question is the rate at which equipment and technology for larger capacity reactors can be developed and installed in Eastern Europe and the

[29] Stern., op. cit. 178. Table 15.1.

European part of the USSR. It is also important to this strategy that no popular discontent such as might be engendered by a nuclear accident will significantly retard the CMEA nuclear program.

In the period up to 1985, the CMEA energy situation appears to be manageable given some minor adjustments and reduced economic growth in all countries. This is in contrast to the widespread doubt that the West can get through the next five years without massive crises and dislocations. From the point of view of CMEA countries themselves however, this period will see a major shift in their energy strategy since they may become dependent upon outside sources for a small part of their energy supplies. Nevertheless, this will only, in the worst case, exert a strain on world oil supplies of some 75 million tons in 1985 (if Yugoslavia is included, this figure would approach 90 million tons)—all of which will be required by the East European countries. This writer finds it more probable that the CMEA countries will be able to hold their oil deficit to negligible proportions in 1985, or even that the USSR can maintain a small surplus to export for hard currency. To a great extent, therefore, the CMEA countries will retain their relative independence of the world oil market and the vulnerabilities stemming from its fluctuations. It is difficult for this analyst to envision circumstances under which the USSR seems likely to import oil for domestic consumption—even under the worst of all scenarios—before 1990.

Although the USSR will maintain autarky in fuels, by 1985 it will have lost almost its entire capacity to export oil beyond the CMEA countries, a trade which has brought the USSR between one-third and one-half of hard currency earnings in the post-1973 period. This is a serious situation for the Kremlin which has relied on these earnings to support imports of western technology and grain. However, with rising prices on the world oil market and rising Soviet exports of natural gas to the West, the Soviets may be able to keep their hard currency earnings stable. (They will be aided in this task by the very sharply increased price of gold).

The most difficult period as regards energy supplies is likely to be 1985–90, particularly if declines should occur in Soviet oil production. With rising energy consumption throughout the bloc, alternative fuels (primarily natural gas and nuclear energy) would not be able to make up major deficits. The very real problem for the USSR in this period is that if oil production cannot be at least maintained in 1985–90, the choice (which will have to be faced almost immediately) will be between reducing (possibly phasing out almost entirely) deliveries of energy to Eastern Europe and accepting considerable constraints on oil utilization in the USSR. It is in this situation that the East Europeans, and perhaps the Soviets on their behalf, will be actively looking to import large quantities of oil from OPEC producers. In the worst case, the magnitude of the shortfall that the CMEA countries will be looking to make up could be as much as 125–150 million tons in 1990. It is impossible to imagine the East Europeans (or the Soviets) being able to support that magnitude of imported oil if payments were made in hard currency, and for that reason, if it proves impossible for them to procure oil on non-hard currency terms, their imports are likely to be limited to around 50 million tons with extremely deleterious consequences for economic growth rates throughout the region.

However, this writer finds it improbable that Soviet oil production

will fall materially below 605 million T/Y in the 1980's. If this level of production can be maintained, there is still likely to be an import of around 50 million T/Y by Eastern Europe, but the consequences for economic growth rates throughout the bloc are rather more optimistic.

After 1990, the situation may ease somewhat due to the expansion of nuclear power throughout the bloc, but particularly in Eastern Europe. Greater volumes of Soviet gas will be flowing to Eastern Europe and it is entirely possible that the Friendship oil pipeline will be switched over to gas in order to rapidly boost the volume of gas trade in the face of a reduced transfer of oil between the countries. The East European countries will however, bear the brunt of CMEA energy problems as the Kremlin planners juggle with available fuel supplies, the first priority being a sufficient supply for Soviet citizens.

In facing the future, Soviet energy planners must find some solution to the interface of three problems:

1. The burden of supplying other CMEA countries, primarily those in Eastern Europe.
2. The problem of the geographical gap between centers of production and consumption.
3. Problems of technology concerning energy exploration, production and transportation.

The first of these problems is by far the most important, both because it has repercussions for the unity of the CMEA countries as a whole, and because without the commitment to supply these countries, the energy problems of the Soviet Union virtually disappear as far as ensuring adequate supplies are concerned. The other two problems are interrelated and it should be noted that while the second may worsen over the next two decades, the Soviets have amassed considerable experience in dealing with the third and may be able to use this to good advantage, especially if some western help is forthcoming.

Overall, this survey of CMEA energy over the next twenty years suggests that difficult times lie ahead for all the countries, but particularly those in Eastern Europe. For the Soviet Union, a curious paradox may arise that while it will not become vulnerable in the energy sector, in terms of importing energy supplies which could be cut off, the Soviet economy may well become constrained by energy problems, particularly relating to oil, especially in the late 1980's. Nevertheless, the Soviet Union's biggest energy problem is not oil, it is Eastern Europe, and the future trading relationship between the Soviet Union and those countries needs to be studied very closely. The one development that could very greatly ease the energy situation of the CMEA countries over the next two decades would be the acquisition of oil on non-hard currency terms from oil producing countries. The chances and opportunities for this development are addressed in the following section.

EDITOR'S NOTE.—Mr. Stern's chapters were drafted in 1980. Subsequently, the CIA revised its estimate of Soviet oil production upward. The CIA now forecasts production of 10–11 million barrels per day (the equivalent of 500–550 million metric tons per year) in 1985, declining to 7–9 million barrels per day (or 350–450 million tons per year) in 1990. Still, the CIA's remain the lowest of the predictions Mr. Stern discusses. The Agency's new estimates, which are to be published in final form in summer 1981, were previewed by Dr. Joseph A. Licari in "Linkages Between Soviet Energy and Growth Prospects For the 1980s" in a paper presented in April 1981. (NATO. Economics Directorate. Colloquium 1981. "CMEA: Energy, 1980–1990." Brussels, April 8–10, 1981.) According to press reports, the CIA now predicts that the Soviet Union may not have to import oil on its own account as early as 1985. (Steve Mufson. "CIA Alters Its Soviet Oil Forecast." Wall Street Journal, May 18, 1981, p. 31 John M. Berry. "CIA Expands Forecast of Soviets' Oil Output." Washington Post, May 20, 1981, pp. A1, A15, and Bernard Gwertzman. "C.I.A. Revises Estimate, Sees Soviet As Oil-Independent Through 80's." New York Times, May 19, 1981, pp. A1, D11.)

III. SOVIET AND EAST EUROPEAN RELATIONS WITH THE ENERGY HEARTLAND

By Jonathan P. Stern*

Chapter II of this study has identified a modest (by western standards) energy imperative facing the USSR and Eastern Europe over the coming two decades, the severest period of which will occur during 1985–90. This chapter will consider the kinds of options that the CMEA countries have at their disposal in their search for supplies of oil—the primary fuel which will be in short supply—and what kinds of actions these countries, primarily the Soviet Union, might resort to in order to procure oil supplies in a situation where their needs were being denied and/or ignored by OPEC countries, or outbid by western consuming countries.

Soviet relations with the Third World have not been extensively documented in any sphere other than the Middle East and Persian Gulf. This can partly be attributed to western interest in the region and partly to the intensive arms and aid program mounted by the Soviets in Egypt in the period up to 1972. Academic publications have tended to concentrate on two major strands of Soviet relations with the Middle East (East European relations have not been addressed at all, or simply regarded as part and parcel of the Soviet situation) : the question of Soviet failure in Egypt (and to a lesser extent in Syria and Iraq) to impose a Soviet model of economic development and political allegiance on an LDC; the question of Soviet attitudes as to the Arab-Israeli conflict—whether the Soviets want to see a settlement and if so, of what kind. Somewhere in the conclusions of these works, the strategic significance of the region is mentioned and the issue of access to oil is raised, but this is seldom accorded by any rigorous treatment.

By contrast, government analysts tend to address the strategic, including energy, aspects of the question. All Soviet activities are regarded as part of a master plan to take over the entire region and its oil resources; any problems that the West is having in the Persian Gulf and any changes in the political status quo to the detriment of the West serve as "proof" of the existence and success of such a Soviet master plan.

Any judgment of Soviet action in the Middle East rests on a personal view of the aims behind the conduct of Soviet foreign policy. Nevertheless, it is one thing to consider that the Soviets would like to control the Middle East and its oil fields, and quite another to hold that the Kremlin considers this to be a serious possibility in the foreseeable future, or even that all Soviet efforts in the region are aimed at such a master plan. Less controversial is the view that the Soviets are not averse to actions which inconvenience and weaken the West, and

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that with western vulnerability to interruptions in the flow of oil so clearly demonstrated, Soviet action to influence the flow of oil from the Middle East may have assumed greater priority in Kremlin thinking.

By this route we arrive at the twin concerns of Soviet policy toward the Middle East: Influence on governments and acquisition of raw materials to benefit the Soviet cause, plus the denial of influence and raw materials to the ideological opponents in the West. These processes are of course related and one has to remember that in a tight world oil supply situation, an increase in OPEC supplies to the communist countries will automatically mean less for the West. Thus, the commencement of oil problems in the CMEA region should be a matter of great concern for western countries, in that it adds an extra dimension to Soviet and East European relations with the Middle East (which have until now been seen primarily in political and strategic terms) in the form of the communist countries as serious competitors for (what would appear to be) a progressively dwindling amount of oil in world trade. In this competition the West has a major advantage; the communist countries with their shortage of convertible currency and their poor level of technological advancement have little to offer oil producing countries, indeed they constantly seek to purchase or barter oil on concessionary terms, i.e., soft currencies, counterpurchase deals, etc. It appears that the communist countries will remain in this inferior economic position, as far as trading with OPEC countries is concerned, for the foreseeable future and it is in this light that oil trading relationships must be considered.

This chapter will deal with Soviet and East European attempts to gain supplies of oil from the Middle East in the past and the possibilities for the future. Evidence as to whether the communist countries have sought to deny the West vital oil supplies will also be briefly examined.

1. Oil and CMEA Relations With the Middle East

The CIA was not the first source to suggest that the Soviets would need to enter the world market for oil in the 1980's. In 1967, the Polish analyst Stanislas Albinowski suggested that by 1980, the CMEA countries would find themselves in deficit by as much as 100 million tons [1] and that this would increase thereafter. Since that time, western commentators have periodically addressed themselves to the issue of oil as one strand of Soviet policy in the Middle East.[2]

Notwithstanding these observations, the primarily "ideological" orientation of Soviet policy toward the Middle East resulted in primary Soviet interest in Egypt and Syria—countries with only a modest resource base. While the Soviets made effort to expand ties with Algeria, Libya, and Iraq, oil played only a small part in these relationships and formed payment for Soviet deliveries of aid, equipment, and expertise, sometimes to the oil industry of the recipient country. As the table shows, apart from the deliveries from Iraq, the Soviets exported almost as much oil as they imported up to 1976 (when oil trade statistics ceased being published).

[1] Albinowski in Lincoln Landis, *Politics and Oil: Moscow and the Middle East.* New York: Dunellen 1973.

[2] Robert E. Hunter, *The Soviet Dilemma in the Middle East: Part II.* Oil and the Persian Gulf, Adelphi Paper No. 60, IISS, October 1969. Also Abram S. Becker. "Oil and the Persian Gulf in Soviet Policy in the 1970's." In Michael Confino and Shimon Shamir, eds. *The USSR and the Middle East.* Jerusalem: Israel University Press 1973 pp. 173–214.

TABLE 18.—SOVIET TRADE IN OIL WITH SELECTED MIDDLE EAST COUNTRIES

[In thousands of tons]

	Exports				Imports			
	1973	1974	1975	1976	1973	1974	1975	1976
Afghanistan	165	193	149	149				
Egypt	352	229	231	226	209	172	211	154
Syria	36	51	2	385	247	330		450
Algeria							948	
Iraq					11,101	3,888	5,304	5,821
Libya					1,713			
Morocco	943	647	649	665				
Total	1,496	1,120	1,031	1,425	13,179	4,390	6,499	6,425

Source: Vneshnyaya Torgovlya SSSR for the respective years.

This is perhaps not surprising as the acquisition of oil has not been high in Soviet foreign policy priorities. What it has meant however, is that the Soviets have not succeeded in forming any kind of trading relationship with large oil producers such as Saudi Arabia, Kuwait and UAE. Relations with Iran blossomed in the latter years of the Shah's reign, largely due to Iranian gas exports to the southern republics of the USSR, which commenced in 1970.

TABLE 19.—SOVIET TRADE WITH SELECTED MIDDLE EAST COUNTRIES

[In millions of rubles]

	Exports				Imports			
	1973	1976	1977	1978	1973	1976	1977	1978
Algeria	64.7	131.4	123.4	88.3	52.1	58.9	39.4	51.3
Iran	137.3	217.9	424.1	432.7	139.6	226.7	283.4	238.4
Iraq	141.5	341.6	281.0	673.7	190.6	372.9	321.0	410.3
Libya	14.1	16.2	20.8	51.8	30.4		76.9	106.8
Saudi Arabia	2.9	13.2	14.1	8.1				
Kuwait	7.9	10.1	21.5	36.6			2.5	
United Arab Emirates		4.6		1.8				

Source: Vneshnyaya Torgovlya SSSR for the respective years.

The reasons for this lack of trade (and in some cases even diplomatic relations) are complex, but in many cases they relate to the antipathy of Muslim regimes to the atheistic tenets of communism and a widely held fear of Soviet expansionism. In addition, the overwhelmingly pro-western orientation of Saudi Arabia, Kuwait and the UAE, bolstered by the presence of western oil companies, works to enhance anti-Soviet feelings and further exclude Soviet influence.

Soviet attempts to gain influence over Middle East oil supplies could be dated from the attempt, immediately after the Second World War, to claim an oil concession in Iranian Azerbaijan. This was part of a more wide-ranging Soviet effort to set up "autonomous" republics in Azerbaijan and Kurdistan (a similiar attempt had been made in the 1920's).[3] These attempts failed, but they were important more as a pointer toward Soviet territorial ambitions on the southern flank, with the oil concession as a side issue rather than the main rationale of the exercise.

[3] R.K. Ramazani, "The Autonomous Republic of Azerbaidzhan and the Kurdish People's Republic: Their Rise and Fall," in ed. Thomas T. Hammond, *The Anatomy of Communist Takeovers*. Yale University Press, 1975.

In the period from 1950 to the late 1960's, oil could hardly have been termed a major factor in Soviet-Middle East relations. The commodity was relatively cheap to buy on world markets and the Soviets had such a large quantity surplus to domestic requirements that it was feared they would flood the world market and wreak havoc with the world oil price. The theory of the so-called "Red Oil Menace," vanished as quickly as it had appeared when it became clear that, despite Enrico Mattei's defiance of the general western boycott of Soviet oil, the USSR would not become a major factor in oil trade outside the CMEA area. By the end of the 1960's, however, with the Soviets depending on Siberian oil to satisfy future requirements and Eastern Europe (with the exception of Romania) almost totally reliant on the USSR for increasing oil requirements, the Kremlin began to suggest to its allies that they should seek at least a part of their oil requirements from non-Soviet sources. At the time, this caused no great furor. The East Europeans set about establishing oil trade relations with OPEC countries; in this they were aided by Soviet penetration into the oil industries of a number of countries.

The Baath Party, which came to power in Iraq in 1968, began a program of indigenous oil technology development for the Iraq National Oil Company (INOC) as a prelude to nationalizing the western interests in the Iraq Petroleum Company (IPC). Unsurprisingly, given the ideological bias of the Baath and the fact that the measures were ultimately aimed at displacing western companies, INOC concluded agreements with the USSR and Hungary for the exploitation of the North Rumailah oil field. Payments for equipment, technology and know-how were to be in crude.[4]

Perhaps it was a coincidence that the start of drilling in the North Rumailah field coincided with the nationalization of IPC interests. A number of commentators concluded that the nationalization was a direct result of Soviet pressure.[5] But Majid Khadduri, in an interview with Saddam Hussayn, concluded that the Baath Party had considered nationalization for some time, even before acceding to power and although, "The Soviet Union had been consulted on the matter (and) agreed to nationalization in principle, (it) seems to have given Iraq no encouragement in the drive to nationalize western oil operations."[6] The Soviet Union for its part claimed that the Friendship Treaty between the two countries had made the nationalization possible. Whether or not this was true, the result was more Soviet and East European involvement in the industry with further payments in crude oil for equipment and technology supplied by the communist countries.[7]

Another country from which the Soviet Union and East Europe were able to secure oil supplies was Libya, although the wild swings in Colonel Qadhafi's foreign policy with its periodic violently anti-Soviet interludes, did not make for an easy relationship. Soviet efforts paid off in 1974 when, following an East European trip by Libyan Prime Minister Jalloud, oil agreements were signed with Hungary, Romania and Czechoslovakia.[8]

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[4] Majid Khadduri, *Socialist Iraq*, Washington, D.C.: Middle East Institute 1978, p. 124.
[5] Foy D. Kohler, Leon Goure and Mose L. Harvey, *The Soviet Union and the October 1973 Midde East War*. University of Miami, 1974. pp. 78–89.
[6] Khadduri. p. 126.
[7] Arthur Jay Klinghoffer, *The Soviet Union and International Oil Policies*, Columbia University Press. New York, 1977. pp. 134–139.
[8] Galia Golan., *Yom Kippur and After*, Cambridge University Press 1977, pp. 199–200.

One country where the East Europeans were fairly successful in their quest for oil in the late 1960's and early 1970's, was Iran. Although nobody could have accused the Shah of being pro-Communist, East European countries had built up a relatively close relationship with Iran in the energy sector with Romania, Bulgaria, Poland, Czechoslovakia and Hungary concluding oil import agreements with Tehran. The Shah also provided some of the finance, and had reportedly been willing to supply some of the crude, for the Adria pipeline (described below).

Such limited success as the East European countries encountered in their quest to import Middle East oil was brought to an abrupt halt with the quadrupling in the world price of oil from the Middle East. The need to find a great deal more money to purchase the same quantity of oil was in some senses more serious for Eastern Europe than for other countries since the transition from a coal-based to an oil-based economy was only just being accomplished and therefore the momentum of the energy balance was in precisely the wrong direction.

In addition to this, the attitude of producer countries towards oil trade with Eastern Europe changed dramatically. All East European imports were paid for with deliveries of goods, equipment and technology (sometimes in support of the indigenous oil industry). However, as world oil supplies became tight and producers began to reap enormous revenues, lines of western customers formed who were willing and able to offer convertible currencies and/or the best technology and manufacured goods available. Unable to compete, the CMEA countries (including the USSR) found themselves pushed out of Middle Eastern markets.

The Romanians were least affected by this trend since they had long term links with the oil producers and could also offer technology and expertise based on nearly a century of experience in the industry. The lack of hard currency earning potential in Eastern Europe has meant that those countries have little chance of purchasing anything other than marginal quantities of oil on the world market. Current levels of indebtedness virtually rule out any possibility of Eastern Europe being able to borrow funds in the West in order to finance hard currency oil purchases.[9] East European countries are therefore looking purchased in the West and therefore, there must be some non-commercial terms. From the standpoint of the producer, these countries are offering products and expertise inferior to that which could be purchased in the West and therefore, there must be some non-commercial rationale for entering into oil trade with them.

An important step toward oil trade between Eastern Europe and the Middle East was taken in 1974 with the signing of an agreement to construct a pipeline from the Adriatic coast of Yugoslavia to Hungary and finally to Czechoslovakia. The agreement between the three countries saw Yugoslavia putting up around one quarter of the total investment and securing 24 million of the 34 million tons that will eventually flow through the line. The other two countries provided about 10% of the investment and will share equally the remaining

[9] The CIA estimated the gross hard currency debt of the six East European countries at $54.7 billion at year-end 1979. *Estimating Soviet and East European Hard Currency Debt.* ER 80–10327, June 1980.

10 million tons of oil. The balance of the investment was provided by Kuwait (which also supplied the pipe) and Libya, with contributions also from the World Bank and the International Investment Bank in Moscow.[10]

The pipeline was completed rather behind schedule at the end of 1979 and a report in mid-1980 noted the commencement of deliveries to Yugoslavia and Hungary.[11] What has never been entirely clear is where the crude would be coming from and the means of payment. It was assumed that since Kuwait and Libya were contributing funds, they would also contribute oil. It was also rumored that Iraq had agreed to supply a portion of the oil as had Iran (when the Shah was in power). With the line now completed, the question of supply is becoming rather more urgent and although Yugoslavia appears to have concluded an agreement with Iraq, there has been no announcement from the other two countries. As of mid-1980 therefore, it is likely that the pipeline is carrying considerably less than the 20 million tons initial capacity, with as yet no crude at all reaching Czechoslovakia. It is certain that Hungary and Czechoslovakia are experiencing difficulty in persuading OPEC countries to supply oil on concessionary terms. This is the nettle that all the East European countries will have to grasp if they intend to increase oil imports from the Middle East over the next decade.

A peculiarity of CMEA oil trade with regard to imports from outside the bloc is worth mentioning here. It is believed that all crude oil listed as "imports" in the Soviet foreign trade handbook is diverted straight to Eastern Europe (or other CMEA countries, or even to Western Europe as Soviet "exports") and fails to touch Soviet soil. Close study of Soviet foreign trade statistics suggests that some of these transactions are recorded as imports while others are not. (Those who seek a pattern in Soviet statistical reporting are often disappointed.) It is equally likely that East European countries count Soviet reexports as imports from the USSR. In this situation, it is nearly impossible to determine actual volumes of oil that each East European country receives from outside the bloc, or the source of this oil.

Apart from Romania, whose well developed links with oil exporting countries have led to imports from Algeria, Kuwait, Saudi Arabia, Iran, Iraq and Libya; the oil trading links between East European CMEA members and OPEC countries have been somewhat piecemeal and fragmented. Czechoslovakia imports the small fraction of its oil requirements that the USSR does not supply from Iraq. The GDR imports over a million tons of crude from Iraq and smaller quantities from Iraq and still smaller quantities from Algeria, Syria and Egypt. Bulgaria receives oil from Libya and Algeria, while Hungary imports from Iraq in return for technical equipment and assistance for the oil industry. Poland, at present the largest importer of oil from the Middle East, receives around 2 million tons split between Iran and Iraq.[12]

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[10] Jeremy Russell, *Energy as a Factor in SovietForeign Policy*. RIIA/Saxon House, 1976, pp. 228–9. *BBC Summary of World Broadcasts*, June 8, 1976. Tanjug in English.

[11] "Eastern Europe's First North-South Oil Pipeline Starts Deliveries to Hungary." *International Petroleum Times*, July 1, 1980, pp. 18–19.

[12] The Statistical and Foreign Trade Yearbooks of CMEA countries and OPEC countries have a certain amount (often contradictory) information about this trade.

2. Soviet Relations With OPEC Countries in the 1970's

It is interesting to speculate on the comments one might have made on this subject if the time of writing had been ten years ago, in mid-1970. At that time one would have observed the tremendous strides that the Soviets had made in the region over the previous decade: the alliance with Egypt and the presence of Soviet forces of all kinds in that country. The same kind of progress in Syria; the coming to power of the Iraqi Baath party, ideologically aligned (after a fashion) with the USSR and the latter's interest in the oil fields of Iraq. The improvement of Soviet relations with Iran after a prolonged period of hostility and the establishment of a long-term energy link in the form of a natural gas pipeline between the countries. The close relationship with the Boumedienne regime in Algeria and the unknown (but hostile to the West) Colonel Qadhafi in Libya. [13]

In 1970, therefore, it would have been a fair judgment to predict ever-increasing Soviet presence and influence in the region, coupled with increasing Soviet and East European access to Middle East oil. In the event, the following decade saw nothing of the sort. Soviet influence was eliminated in Egypt and drastically weakened in Iraq, while the change of regime in Iran has yet to offer any economic or political advantage to Moscow. Although Soviet influence in surrounding areas such as Yemen, the Horn of Africa and Afghanistan, has grown, these are poor substitutes for the countries where influence has been lost and do nothing to directly enhance Soviet access to Middle East oil. Nevertheless, Soviet and East European requirements for oil have grown and although political influence may have waned, military capability has increased enormously. These are the broad perspectives which should bear on any analysis of Soviet relations with Middle East countries over the next two decades.

In the absence of a major change of political orientation (such as occurred in Iran) in one of the key oil producing monarchies in the Arabian Peninsula, it is very likely that Soviet and East European oil trade will remain concentrated on Iraq, Iran and North Africa (i.e., Libya and Algeria). The changing political landscape within and between Iran and Iraq, will afford the Soviets certain opportunities to gain political influence which may in time bring access to oil. It is worth noting that of the countries mentioned, only Iran and Iraq have the capacity to significantly expand exports in the future.

Over the past decade, Iraq has been a country both physically and intellectually inaccessible to Westerners. The actions and policies of the Baath regime which has ruled since 1968 often appeared as unintelligible as they were brutal and this fact combined with the one-time strongly pro-Soviet stance of the Baathists, led many to regard Iraq as virtually a Soviet client state. A 1979 analysis noted that, "At the State Department . . . it is almost a reflex action to label Saddam Hussein a bluff artist, paranoid about internal dissent and so beholden to the Soviet Union as to be incapable of autonomous foreign policy, let alone the delicate task of coordinating inter-Arab economic and diplomatic objectives. In fact, Washington has severely misjudged the man and underestimated the capability of his government." [14]

[13] These are the rough conclusions reached in Hunter., *op. cit.*
[14] Claudia Wright. "Iraq—New Power in the Middle East." *Foreign Affairs*, Winter 1979/80, pp. 160–177.

The Baath party pursued an isolationist foreign policy for the first five years of its rule, but as this proved counterproductive in terms of internal economic development the country turned to outside powers for assistance. The first move was toward the communist countries for economic assistance and technology, but Baghdad found that ". . . the quality of commodities and technological knowhow received from the socialist bloc did not measure up to western standards." [15] From the mid-1970's Iraq increasingly turned to the West and improved relations with the U.S., despite the latter's connection with and support of Israel which is abhorrent to Iraq, that most rejectionist and radical of the "frontline states."

Indeed, careful study of the Soviet relationship with Iraq suggests that economic and political relations deteriorated steadily in the latter part of the 1970's, mainly on account of Iraqi desires to distance itself from Soviet policy and the regime's repressive measures against the Iraqi communist party. The elevation of Saddam Hussein to President in late 1979, if anything, intensified the anti-Soviet stance of the regime. One U.S. expert draws the following conclusions in the evaluation of Soviet policy toward Iraq in the 1968–79 period. ". . . Soviet influence with the elite ruling Iraq is very limited indeed . . . the USSR has been singularly ineffective with the Iraqis on matters of significance to Iraq . . . In addition, as Iraq began to project itself as the leader of the Arab world, its anti-Communist domestic policy began to take on overtones of an anti-Soviet foreign policy . . . All in all, the course of Iraqi-Soviet relations in the 1968–79 period indicates the low level of Soviet influence . . . which has given relatively little in the way of political obedience in return for a large amount of Soviet economic and military assistance." [16]

At the same time, Iraqi relations with the surrounding countries in the Persian Gulf drastically improved. In the late 1960's and early 1970's the country came to the brink of war with Iran; continued traditional hostilities with Syria; maintained a minimal relationship with the Arab monarchies; constantly posed a military threat to Kuwait. In the late 1970's, particularly after the Iranian revolution, Iraq became much less of a maverick and more of a status quo power. This did not modify Baghdad's implacable opposition to the state of Israel and all who deal with it (as in the outright Iraqi hostility toward Egypt). Nor could one ever describe Iraq as being pro-western (in the same way as it was probably an error to see the leadership as pro-Soviet); its ties with the West are out of necessity rather than choice. Nevertheless, Iraqi conciliatory policies toward the more conservative status quo countries in the region, (enhanced by its animosity toward the Khomeini regime reached the point where at the December 1979 OPEC meeting, Iraq was in favor of restrained behavior with respect to oil prices; an incredible development considering the regime's track record as a price hawk within OPEC.

Another important current and potential source of oil for the CMEA countries is Libya, where the regime of Colonel Kaddafi has proved amenable to large Soviet construction and technology proj-

[15] Khadduri. p. 173.
[16] Robert O. Freedman, *Soviet Policy Towards Baathist Iraq*. Paper prepared for Conference on "The Soviet Union in the Third World: Success and Failure", Strategic Studies Institute, U.S. Army War College. September 1979.

ects, such as the building of nuclear power stations. What is unclear is the extent to which these projects receive payment in oil. Even more unclear, given the unpredictability of the Colonel, is the durability of any favorable policy toward the CMEA countries and/or any oil supplies which may accompany this. Any leader who can suddenly suggest that his country may cease to export oil at a moment's notice (even though this has so far not occurred), is unlikely to provide a stable basis on which long term supply relationships can be founded.

It could be argued that Qadhan shares some kind of common ideology with the USSR, but as in the case of Iraq, this can only be identified in terms of anti-Westernism, and especially anti-Americanism, bound up with hostility toward Israel. Qadhafi has passed through some violently anti-Soviet phases on account of his profound Islamic beliefs and consequent hatred of Soviet atheism. Nevertheless, Libya obtains all of its military supplies from the USSR and Soviet arms have been exchanged for Soviet use of Libyan airfields, a kind of parallel to the Iraqi arms deal which involves port facilities for Soviets at Umm Qasr.[17]

The biggest problem in foreseeing the expansion of Libyan, and indeed Algerian exports of oil to CMEA countries (Algeria has periodically exported small quantities of oil to Eastern Europe), is that neither country is expected to expand production very greatly in the 1980's and Algerian production may actually fall. Additionally, these two countries are at present the supreme price hawks in the OPEC group (partly because of the fact that their reserves are dwindling) and therefore, are looking for the maximum return on their oil exports which, needless to say, is hardly to be gained by exporting to the CMEA.

Looking at other oil exporting countries in the region, it is more than four decades since there have been diplomatic relations between Moscow and Riyadh. As has been shown above, commercial relations have been kept to a minimum. There have been signs that the Saudis are coming to terms with the Soviets in the political sphere in order to plan a resumption of diplomatic ties. This was apparently the subject of secret talks between the countries in mid-1979, but how far these discussions were a Saudi signal to the U.S. and/or how far this reflects the attitude of one Saudi academic that, ". . . we shall have to sell oil to the Russians eventually and . . . that must mean diplomatic relation . . .",[18] is difficult to judge. Apart from Romania, there have been no reports of oil trade between Saudi Arabia and CMEA countries, but rumors of significant Soviet gold sales to Saudi Arabia gave the impression that channels had been opened.[19] The Soviet invasion of Afghanistan has undoubtedly placed a further barrier in front of normalization of relations between the USSR and Saudi Arabia, but members of the royal family and particularly Crown Prince Fahd, give the impression that they regard this as an inevitable, even if long-term, development.[20]

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[17] Golan, p. 200; Khadduri, pp. 143–147.
[18] *Sunday Telegraph*, February 11, 1979. page 9.
[19] *Financial Times*, September 21, 1979.
[20] See Adheed Dawisha, *Saudi Arabia's Search for Security*. Adelphi Paper No. 158. IISS. Winter 1979/80. Also the Interview with Crown Prince Fahd in *Middle East Economic Survey*. Vol. XXIII, No. 14. January 21, 1980, pp. 1–3.

As far as the other oil exporting monarchies are concerned, there is no significant trade between the USSR and the UAE or Kuwait. Very small quantities of oil are exported to Eastern Europe from the UAE, and Kuwait was the major Arab sponsor of the Adria pipeline, giving the impression that it would contribute some oil towards the project. In addition, Kuwait has purchased limited quantities of Soviet arms (possibly as an insurance against Iraqi threats).

At the close of the 1970's the two events directly affecting Soviet relations with the Middle East and uppermost in the minds of most western observers were the Soviet invasion of Afghanistan and the consequences of the revolution in Iran. One year later, these two factors had been supplemented (rather than supplanted) by the war between Iran and Iraq.

3. Soviet Activities in Afghanistan

The Soviet invasion of Afghanistan is worthy of a special note here, since, although Afghanistan is not an oil producing country, its proximity to key OPEC producers and the Persian Gulf in general, has led many western observers to conclude that this action was directly aimed at facilitating Soviet access to oil, if necessary by military means. In assessing Soviet motives for the invasion, it is essential to take into account some of the background of Soviet-Afghan relations and also assess the regional situation as it appeared to Moscow at that time.

Soviet interest in Afghanistan has a long history; from 1954 to 1978 Afghanistan received some $1,500 million of aid from Moscow which made the country the largest recipient of Soviet aid during that period after Egypt and India. The tangible return on that "investment" cannot be said to have been very great. Afghanistan is an extremely poor country with no standing in the international community. The country possesses little mineral wealth aside from some iron ore deposits and some natural gas which the Soviets have developed as almost the only modernizing elements of the economy.

In 1978, there were about 2000 Soviet economic advisers in Afghanistan.[21] Soviet military personnel were also numerous, the Russians having been solely responsible for equipping and training the Afghan army. All in all, it is difficult to escape the conclusion that the Soviets could have taken over Afghanistan (or moved through the country on the way to the Persian Gulf) almost without firing a shot at any time during the past decade. This being the case, the primary question must be why they chose December, 1979 and why massive military intervention.

It is certain that the Soviets did not take this action lightly. The movement of a military force of some 85,000 men and their logistical support, requires considerable planning and financial commitment—a decision that would not have been taken without an imperative, which was perceived by the Kremlin to be of the utmost urgency. I suggest that this imperative was the growing strength of militant Islamic forces within Afghanistan, combined with the existence of a government which was increasingly unable to control the internal

[21] Orah Cooper and Carol Fogarty, "Soviet Economic and Military Aid to the Less Developed Countries. 1954–78." *Soviet Economy in a New Perspective.* Joint Economic Committee. Washington, D.C. GPO. October 10, 1979, Vol. 2, Table 3, p. 661.

situation and was becoming unresponsive, if not hostile, to Soviet demands. Thus at one remove, the Soviets felt that they were witnessing the rise to power of an anti-Soviet regime which posed an enormous threat to the 50 million Muslims living in the Soviet republics bordering Afghanistan. The prospect of losing the Soviet investment and influence in the country was sufficiently alarming; the possibility of instability communicating itself to the Soviet Muslim republics was unacceptable.

The timing of the Soviet invasion was the result of the convergence of a number of factors: First, within Afghanistan, where the government of Hafizullah Amin was acting in such a way as to greatly anger the Kremlin. The fact that Amin had (nominally) Marxist leanings added insult to injury when he was unwilling, or perhaps unable, to prevent the slaughter of a large number of Soviet advisers by particularly horrible methods.

Second, within the Persian Gulf region where events in Iran appeared to the Kremlin to be coming to some kind of confrontation with the United States over the hostages in Tehran. Although the Iranian situation is something that the Kremlin can do little about, it must be of some comfort that the important centers of Iranian unrest are at some distance from the Soviet border, whereas the danger of communication of unrest from Afghanistan is much greater. In addition, the uncertain political situation in Pakistan contributed to the impression in the Kremlin that, in the event of massive political instability with an Islamic face on its southern border, it was essential to establish some kind of buffer zone.

Third, in the United States where, some have suggested, the Kremlin had given up on President Carter's ability to get the SALT II treaty through Congress and therefore, according to this view, may have felt that they had nothing to lose in their relations with the U.S.

It is hard to imagine that the Soviets believe that they can control Afghanistan in the sense of making that country "part of the USSR." No regime has ever "ruled" Afghanistan in the western sense of that term. Indeed only Kabul and the surrounding area can ever be said to have been under the control of central government. The hill tribesmen have always been a law unto themselves and coexisted very uneasily with Kabul. It is likely that Moscow simply wished to ensure a non-anti-Soviet, non-Islamic regime in Kabul and accordingly hoped to rapidly crush the dissident forces and pull out leaving a few strategically placed divisions on the border, ready to return if trouble was to flare again. The problem here was that with the harsh winter climate and terrain, the effectiveness of the Soviet (and indigenous Afghan) military machine was impaired and the chance of a rapid victory greatly reduced. It is under these circumstances that a Vietnam-type situation has been foreseen for the USSR—an inapt analogy when considering a country sharing a common border with a superpower, but probably accurate in its reflection of an endless guerrilla war which neither side can win.

There are those who believe that the Soviet move in Afghanistan is the beginning of a long-term strategy to take over the Persian Gulf region and its oil. Although a contrary thesis has been advanced here, it cannot be denied that this action has brought the Soviets nearer to

the Persian Gulf and Indian Ocean, and greatly extended their "border" with Iran. If, however, the intention of the Kremlin was to strike against the Persian Gulf, the act of aggression against Afghanistan was surely a poor first move.

In a regional context, Soviet actions have proved counter-productive in that they have given the USSR the image of "oppressors of Islam", a tag with enormously adverse consequences for their relations with countries in (and beyond) the region, including most of the major oil exporters. In addition, up to the time of the invasion, the Iranian accusations of U.S. aggression and imperialism had somewhat pushed the Soviet threat into the background. The Afghan situation caused a rethink in (or acted as a reminder to) those countries which rely on the U.S. as the ultimate guarantor against Soviet military action. Furthermore, Soviet action seemed to bear out all the warnings that Washington and Peking had been giving regional countries about Soviet intentions toward their territories.

In conclusion, so far from gaining economic advantage and political influence in the region, the Soviets have nothing to look forward to in Afghanistan aside from the prospect of pouring money into a "black hole" for a considerable period of time with a nil return, even in the event of military success. To annex the country would simply add an economically backward, viciously anti-Soviet unit to a country which already has its share of regional problems. Along with this, the Soviets have irrevocably alienated the indigenous population and greatly alarmed the regional countries which were forced to recognize their need for western protection in the face of Soviet aggression.

4. The Iranian Revolution and the Iran-Iraq War

It is still far from clear whether the Soviets played any decisive role in the removal of the Shah and his eventual replacement by the theocracy of Ayatollah Khomeini in early 1979. However, there is little evidence that the Soviets played any direct part in the Shah's downfall, over and above the usual propaganda and finance in support of the Tudeh party which had continued throughout the 1960's and 1970's.[22] On balance, the Soviets must have felt equivocal about the Shah's regime. On the one hand, despite frequent attempts, Moscow had gained little influence in Tehran and did not seem likely to do so while the Shah was in power. On the other hand, economic contacts had been mentioned, oil supplies for Eastern Europe and natural gas for the southern republics of the USSR.

One of the first consequences of the revolution was the cessation of gas deliveries to the USSR which caused considerable suffering in Armenia, Azerbaijan and Georgia in the particularly severe winter of 1978/9.[23] Although supplies resumed in mid-1979, they never regained former levels (partly due to reduced oil production and partly to sabotage of the pipeline), and ceased entirely in March 1980 with the Soviets refusing to pay the new Iranian price amounting to five times the existing rate. Prolonged negotiations have failed to settle

[22] Shahram Chubin, *Soviet Policy Towards Iran and the Gulf*. Adelphi Paper No. 157. Especially pp. 33–34.

[23] For a broad discussion of these events see: C. H. McMillan and J. B. Hannigan. *The Soviet-Iranian Energy Relationship*. Institute of Soviet and East European Studies. Carleton University. Ottawa. November 1979. Especially pp. 21–25.

on a satisfactory price and this in itself says much about the political relationship between the countries.

The question of Iranian oil deliveries to Eastern Europe is rather more complex. When the Khomeini Government came to power, one of their first acts was to cut drastically the level of oil exports including those to East European countries. In April 1980, however, it was announced that Iran was boosting sales to Eastern Europe, particularly Bulgaria and Romania. While no terms were mentioned, it seemed inconceivable that East European countries would have agreed to deliveries in hard currency at world prices (Iran's oil being the most expensive in the world at that time). More likely, and more promising for the East Europeans, is that oil was being traded in exchange for services being performed on a number of large industrial projects which have been abandoned by western firms.[24] Among the projects which the Eastern Bloc offered to take over were the Bandar Khomeini (formerly Shahpur) chemical complex and the supply of spare parts to the Iranian oil industry in the face of the western embargo.[25] This last would be a real coup for the Soviets, for it would give them some direct access and perhaps some measure of control over Iranian oil production. However, the Iranians always seemed keener to find ways of circumventing the embargo rather than entrust this task to the Soviets.[26]

However, hardly had we begun to realistically assess the new situation in Afghanistan and Iran when a war broke out in the Persian Gulf which again promises to radically change the situation in the region in terms of internal and external alignments and, critically, in terms of access to energy supplies. At the end of 1980, the situation was sufficiently unsettled to make it impossible to predict the outcome of the war and the consequences of this for Soviet (or any other country's) policy. Nevertheless, some tentative comments can be made regarding the nature of the conflict and the range of Soviet options and capabilities.

After 2 months of fighting, the major message from the Gulf appears to be that the conflict will be protracted and that the chance of a near term settlement or peace treaty which would be honored by the belligerents is small. The conflict is likely to drag on for some time, with minor but continual flourishes of military power which will set back attempts in both countries to restore normality, particularly to oil supplies.

As far as the USSR is concerned, the conflict, apart from taking the Kremlin by surprise, has raised a number of contradictions in its policy towards individual regional countries. The crystallization of new regional alignments as a result of the Persian Gulf war which has left Iraq, Saudia Arabia and Jordan arrayed against Iran, Syria and Libya (and to a lesser extent Algeria), has made life exceedingly difficult for Moscow. Two weeks into the war, the Soviets concluded a treaty of friendship and cooperation with Syria. This action, combined with its relations with the North African countries (as opposed to its relative lack of contact with Iraq's allies), seemed to bring

[24] Andrew Whitely, "Big Rise in East Bloc's Iran Sales." *Financial Times*, June 10, 1980.
[25] Simon Henderson, "Soviets Offer Tehran Spare Parts for Oil and Gas Equipment." *Financial Times*, March 28, 1980.
[26] Simon Henderson, "Iran 1b. 63 m. Order Avoids U.S. Ban." *Ibid.*, July 17, 1980.

Moscow down firmly on the Iranian side of the conflict. This impression was reinforced by two (unconfirmed) Soviet offers of arms to Iran, in August and again two weeks into the fighting in October. Both were said to have been refused with the Iranian line that the Soviets should cease supplying Iraq with arms.

Curiously enough, Moscow appears to have implemented just such action, with fragmented reports suggesting that while arms and ammunition shipments to Iraq may not have been totally suspended, they have not been escalated in line with the requirements of a war situation, despite the requests of Iraqi officials on visits to the USSR. Soviet actions undoubtedly reflect disapproval of Iraq's commencement of hostilities and a determination not to allow the conflict to escalate. More importantly, they may also reflect a Soviet desire to see Iraq render something tangible to Moscow in return for aid and support received in the past, and a lesson to Baghdad (and other recipients of Soviet arms) that the USSR has the power to withhold critical military support if it considers that the recipient's record of political (and economic) allegiance has been unsatisfactory.

In the short term, Moscow has to worry about the cessation of oil supplies from the two countries which will have adverse repercussions in Eastern Europe. Long term commercial considerations center on the opportunities which the war may have provided for large scale Soviet and East European involvement in (particularly oil) construction projects in the two countries. In addition, both Iran and Iraq will be looking to significantly expand their defense capabilities in the near future, presenting further commercial opportunities. Politically, however, Moscow must know that the animosity between the two countries may mean that unpleasant choices have to be made in terms of commercial, military and political support. Such choices will be just what Moscow is trying to avoid, since the best of all outcomes for the Soviets might well be the protracted destabilization and radicalization of both countries, such as might occur in a period of economic and social disruption caused by a long war. The Soviets would also like to see the breach between Iraq and Syria—the two regional countries with which it has Treaties of Friendship and Cooperation—healed, but it must know that its own influence in this process will be extremely limited, as it has been over the past decade. If Moscow could form a commercial (particularly in energy) relationship with Iran (preferably without Khomeini) and at the same time persuade a destabilized and economically weakened Iraq (preferably without Saddam Hussein) to come to a truce with both Tehran and Damascus, then the Soviets would have scored a decisive victory in the region. The fact that this situation will probably not occur in the short or long term, or that if it does the Soviets will have played a minor part in bringing it about, will continue to underscore Soviet frustrations at being unable to decisively influence regional developments.

The conventional wisdom, which surfaced in the West after the Iranian revolution and the invasion of Afghanistan, that the Soviets had decisively increased their influence in the Middle East, was fundamentally flawed in that it confused Soviet influence with the decline of Western power. The Iran-Iraq war leaves Soviet policy and options as muddled as those of the West, with only marginally more power to influence the outcome of the war (by massively rearming Iraq), while

the West's hands are tied with uncertainty on the part of the Europeans and unwillingness on the part of the Reagan Administration to supply arms to Iran.

The significant difference between the Soviet and Western positions is that it is almost impossible to see events developing in such a way that the West will not be seriously inconvenienced by the short (and perhaps long) term energy and security consequences of the war. Aside from this, all these events have provided the USSR with opportunities to gain political and economic influence in Iran, where animosity towards the West (and particularly the U.S.) may be sufficiently protracted to allow the Soviets and especially the East Europeans, to obtain a substantial and lasting commercial foothold.

This overview of Soviet and East European relations with oil exporting countries suggests that little actual progress has been made in improving relations with, or securing greater deliveries of oil from, those countries over the past decade. Nevertheless, at the close of 1980, some opportunities have opened up which could be turned to the political and commercial, including oil, advantage of the communist countries. While possibilities exist for expanding an oil trading relationship with Middle East countries, there is as yet no sign that the CMEA countries would be able to persuade OPEC to part with significant quantities of oil on terms other than hard currency payment (which Eastern Europe cannot afford and Moscow will not purchase on its account). Moreover, in the absence of a change in attitude on the part of a significant oil exporter, such as one of the belligerents in the Iran-Iraq war, there is no sign that OPEC countries are interested in expanding economic relations with CMEA countries to a significant extent or that political relations are likely to improve to the point where the CMEA would receive favored economic treatment.

If this analysis is correct, then at present there seem to be a limited number of options at the disposal of the communist countries in their quest for increased oil supplies:

1. Await political changes in OPEC countries favorable to CMEA.
2. Engineer such changes in OPEC countries.
3. Invade OPEC countries by force and secure oil supplies needed by CMEA countries.

Before considering the feasibility of these options and the ways in which the Soviets and their allies might go about trying to realize them in the 1980's, it is important to note that the Middle East is by no means the only region from which CMEA countries could expect to import oil. In the 1970's, with the considerable expansion of CMEA activities in the Third World, other possible sources of oil supplies have been opened up which it is necessary to briefly consider.

5. Possible Oil Suppliers Outside the Middle East

The USSR and Eastern Europe need not necessarily depend on OPEC countries for non-Soviet oil supplies. Other avenues have been explored and efforts in this direction will undoubtedly be stepped up in the future.

Casting their gaze at the other oil producing region contiguous to them, it is known that both the USSR and Poland have approached Norway for oil supplies and even drilling concessions in the Norwegian

North Sea. Oslo turned down both proposals flat (although Norway imports Polish coal and some electricity from the USSR), making it known that a concession would be unacceptable and that there would be little oil to spare in the foreseeable future. Possibilities exist for joint Soviet-Norwegian energy development in the Barents Sea, but this would need to follow a territorial agreement between the two countries in that region.[27] No such agreement is at present in sight.

A more far flung source of oil for CMEA is what one might call the Caribbean/Central American connection. An interesting and little-remarked development is the observer status of Mexico at CMEA economic meetings. Mexico has signed oil agreements with the USSR, Bulgaria and Yugoslavia (although there is no indication that any actual crude oil deliveries are involved) and oil technicians from all three countries are involved in Mexican exploration.

The ultimate aim of CMEA economic relations with Mexico is to offload Soviet responsibilities for supplying Cuban oil. Logistically, this may have already been achieved since, in view of the transport costs of delivering Soviet fuel to Cuba, an agreement has been reached by which Mexico will deliver oil to Cuba and the USSR will deliver an equivalent quantity to Spain.[28] With Mexican deliveries to Spain running at about 10 million tons, it is possible that the logistical agreement could see Cuba's entire requirements being supplied by Mexico. The logistical arrangement was due to commence from 1980, but in the past there had already been rumors of similar deals involving both Mexico and Venezuela.

It is important to note that this arrangement does not save the CMEA energy balance any oil, but eases the transportation costs of oil within the alliance. The next step would be for the CMEA countries to persuade Mexico to supply Cuba's oil requirements, simply as part of bilateral trade between the countries. This may not be out of the question as relations between Mexican President Lopez Portillo and Fidel Castro are extremely cordial as demonstrated in the recent mutual state visits. Cuba may well hope to benefit by the joint Mexican/Venezuelan plan to sell oil to Caribbean countries on concessionary terms. However, this may be tempered by the hostility of Venezuela towards Cuba and the determination of Caracas to limit (what is perceived as creeping) Soviet influence in Central America and the Caribbean. With the Cuban involvement in both Nicaragua and Grenada and serious political instability in other parts of the region, there are definite opportunities for an extension of Cuban presence. It has been suggested that a prime Cuban target might be Trinidad with its oil and gas resources which would be an exceedingly useful source of fuel for the ailing Cuban economy.

Another major oil producing region from which CMEA countries may be hoping to obtain supplies is sub-Saharan Africa. The Soviets and East Europeans have been involved in some large construction projects in Nigeria and at least part of the Nigerian armed forces are equipped with Soviet weapons and aircraft. In addition, Soviet and East European support for the present regime in Angola may in time yield some oil for the CMEA. While at present the CMEA countries

[27] An outline of the disagreement between the USSR and Norway over the Barents Sea can be found in, J. L. Russell, *Energy as a Factor in Soviet Foreign Policy*. RIIA/Saxon House, 1976, pp. 185–186.

[28] *The Guardian*. May 21, 1979 and August 31, 1979.

are not thought to have obtained oil from that part of the world, it is interesting that East German activities in Africa have come to be regarded (partly) as quid pro quo for continued deliveries of Soviet oil.[29]

Finally, although the USSR currently supplies Vietnam with some 600,000 tons of oil annually, there has been a concerted effort by Moscow to become involved in Vietnam's offshore exploration effort. Although it is not certain how this can be accomplished, given the lack of Soviet equipment and experience in this field, it is evident that Moscow would like to be linked to a possible new source of oil wealth in South East Asia.[30]

6. Soviet Policies Toward the Middle East Over the Next 20 Years

The USSR has at its disposal a range of policies from near-total isolationism to massive military intervention in the Middle East, all of which are feasible alternatives depending on the various scenarios that one could construct for events within the region.

At one extreme, the USSR can afford to remain aloof (at least in oil terms) from any events in the Middle East over the next decade. This will not, of course, occur since, as has been indicated, the USSR has vital national security interests in the region and in addition, has always been sensitive to regional developments whether or not these impinge on its national security. The USSR can therefore afford to allow events to take their course in the Persian Gulf and act to promote its best interests as it sees fit. The region is beset with strife, both within and between countries and groups of countries, to the point where the absence of some kind of regional conflict for any long period of time is inconceivable.

This does not have to be an event with as much significance as the Iranian revolution; indeed it need not involve any drastic regime change. The constantly shifting alliances of regional countries—Iraq, Syria, Egypt, Libya—forming different regional groupings amongst themselves (causing changes in their relations with the West), will give the USSR plenty of opportunity to select courses of action which involve very little risk or cost to itself. Once again we have a situation in which the reactions of the USSR are not crucial to its economic life in the way that western (including U.S.) reactions are. In a conflict between two regional countries, the biggest decision the USSR may have to make (as for example in the Ethiopia/Somalia conflict) is which country to support in the cause of maximizing its own interests. A wrong decision may involve a loss of prestige, perhaps a waste of economic and military aid, but even if this were to lead to some action over oil supplies in the form of an embargo against the Soviet Union or a complete break with one of the producing countries (something that the Soviets would naturally try to avoid at all costs), this would not be a catastrophic situation.

An important theme of this chapter is that the USSR does not need to react to a crisis situation caused by actions of OPEC producers

[29] George A. Glass, "East Germany in Black Africa: A New Special Role?" *The World Today*, August 1980, pp. 305–312.
[30] "USSR Enters Vietnam's Offshore Search." *Petroleum Economist*. August 1980, p. 348.

because these actions do not affect its domestic economic situation in the way that they cause havoc in western economic circles.

Moving to a slightly more assertive Soviet role in the region (and closer to the way in which a consensus of analysts would actually characterize Soviet policy over the past two decades), one could see the Soviets actually taking steps to hasten the kind of progress, in terms of regime changes, that they wish to see in the region. The constant Soviet propaganda exercise to encourage pro-Soviet (and anti-western) policies has already been mentioned. In practice this has tended to mean support for local communist parties and breakaway dissident factions, particularly guerrilla movements (such as the Palestinians, Kurds and more recently the Turkomans in Iran). Such support is usually limited and can be removed at very short notice if direct (and more promising) relations with the regime are established. In addition, the Soviets have often tolerated crushing slaughter of regional allies, especially local communists, without retaliation beyond a strong editorial in Pravda.

This type of "low level" intervention by the Soviet Union could take all kinds of forms and be used to escalate a varietv of conflicts never far from the surface in the region. If, for example, the Soviets were to decide that they were losing influence with Saddam Hussein's regime in Iraq to the point where a change of government might be in their favor, it would not be beyond Moscow's powers to exacerbate internal disturbance for the narrowly based Hussein regime. Alternatively, it might attempt to precipitate or exacerbate trouble between Iraq and its neighbors, Syria and Iran. From a contrary position, if the USSR should wish to promote Iraq as a regional power (with a pro-Soviet bias) it might decide to offer the country advanced weaponry on favorable terms, so as to promote the already well-known expansionist aspirations of the Iraqi leadership vis-a-vis its neighbors.

An important point about Soviet intervention, even at a low level, is *not* that it will certainly, or even probably, lead to the outcome the Soviets wish, but that it will "rock the boat", i.e. disturb the status quo, in a manner that will certainlv be disquieting to any country which depends on stability in the Middle East for continuity of its oil supplies.

It is worth mentioning that if the USSR sees the status quo as counterproductive to Soviet interests, then it may implement such activities simply on the grounds that the outcome may be more favorable to the USSR than the current situation. Much of this low level Soviet activity would, because of difficulties in precise documentation, be hard to attribute directly to the USSR. Thus it would be difficult for the U.S. to deliver an ultimatum to the Soviets on the basis of such minor activity, without threatening a response on a vastly escalated level, compared with the original Soviet act.

The one area in which low level intervention would not be tolerated (and in which the Soviets would probably not even attempt such activity) is the Arab-Israeli dispute. A great deal has been written on Soviet attitudes and policies toward Israel and the Arab-Israeli question.[31] The issues and risks involved in any such Soviet activity would be of a complexity and magnitude to dissuade the Soviets from becoming en-

[31] Most recently, Yaacov Roi, "The Soviet Attitude to the Existence of Israel." and Robert O. Fredman, "The Soviet Conception of a Middle East Peace Settlement." in Ed. Yaacov Roi, *The Limits to Power: Soviet Policy in the Middle East.* London: Croom Helm, 1979, pp. 232–253 and 282–30.

broiled in a situation where the other superpower would become immediately involved.

There are those who hazard that the Soviets will attempt to hinder a solution to the Arab-Israeli dispute on the grounds that the resulting status quo will leave the Soviets without a role to play and will drastically reduce the level of conflict in the Middle East region on which Moscow could capitalize. This is an immensely complex situation, but one must note that although Moscow would like to see a Pax Sovietica rather than a Pax Americana, even the latter must involve the Soviets to some extent. Finally, it is naive to imagine that an Arab-Israeli settlement, important as it would be, would be the complete answer to regional stability, given the number of other internal and crosscutting conflicts.

Moving up the scale to a more aggressive Soviet posture, there is the possibility of Soviet attempts to control "choke points" and vital sea lanes in order to interdict western supplies of oil. The important qualitative difference between these actions and those characterized as low level intervention is that interdiction of supplies, whether carried out by Soviets or Soviet surrogates, whether accompanied by annexation of those supplies for Soviet purposes, constitutes a deliberately belligerent act at a high level of visibility which must be expected to elicit an equally belligerent response on the part of the West, primarily represented by the U.S.

The extreme case of Soviet intervention in the Middle East would be massive military incursion in an OPEC country or countries in order to physically take over oil fields and facilities. Once again, this involves acts of vital economic and strategic significance to the other superpower, a fact that the Kremlin could not fail to appreciate particularly after the American reaction to events in Afghanistan.

Before progressing to discuss what is felt to be the most likely scenario for Soviet involvement in the Middle East over the next two decades, it is important to consider one further factor. Increasingly in western circles it is feared that Moscow might pursue a policy of denying the West access to Middle East oil and that, whether or not this was accompanied by Soviet annexation of oil, the potential for damaging western economic interests would be considerable.

7. Soviet and East European Attempts To Deny the West Access to Middle East Oil

It is often noted by western commentators that as early as 1956, Bulganin and Khrushchev were informed by British Foreign Secretary Anthony Eden that, ". . . for us the oil of the Middle East is a matter of life and death. If the oil is cut off or interrupted, we shall fight." Only rarely is it recorded that Khrushchev replied ". . . please remember that when you are talking about war in the Middle East, this is an area very close to the Soviet Union and if war breaks out there we can't sit idly by." [32] The conversation is worth recalling because it is often forgotten or ignored by western analysts studying the Middle East that by any objective standpoint, the Soviets have a legitimate security interest in the region which adjoins their southern border.

[32] Mohammed Heika, *Sphinx and Commissar*, London : Collins, 1978, p. 131.

If the Soviets could be said to have a "legitimate" security interest in the region, their not so legitimate aims include and sometimes exclusively focus on the creation of an anti-imperialist (i.e., anti-western) bloc of countries in the region. Western analysts have extensively documented Soviet propaganda aimed at persuading OPEC countries to nationalize western oil company interests, use the oil weapon against the West, eliminate western imperialist presence from their lands (and replace it with communist presence).[33] Although it was hazarded that the USSR might even have been the chief instigator of the OAPEC oil embargo, a consensus of studies concludes that, ". . . in spite of the massive emotional propaganda efforts, actual Soviet influence on the oil embargo was minimal." [34] "Whatever the degree of Soviet cooperation in some aspects of military planning, it seems clear that the initiative for the way lay with the Arabs." [35]

Much as the Soviets must have taken considerable satisfaction in seeing the western world in disarray as a result of the oil embargo, they helped to ameliorate the situation for the West, albeit at considerable profit to themselves. The Soviets greatly angered the Iraqis by purchasing oil at pre-embargo prices and reselling to the West at and above the new prices.[36] This was the action of a country out to make a rapid profit, but not of one wishing to add to western misfortune.

Nevertheless, it would be naive to suggest that the Soviets have not taken account of the West's vulnerability to interruptions in, or even simple uncertainties regarding, the flow of Middle East oil and this is an area where pressure may be applied, regardless of Soviet and East European oil requirements.

It has been suggested that there is a great threat from Soviet interdiction of western oil supplies which must pass through the "choke points" of the Strait of Hormuz and the Bab el Mandeb Straits on their way from the Middle East. This concern has come about on account of Soviet political gains in the Horn of Africa and the People's Democratic Republic of Yemen and the access that this affords the Soviets to the Red Sea transit routes. Instability in Iran and Soviet moves in Afghanistan have given rise to western fears particularly concerning this aspect of Persian Gulf security.

Despite obvious Soviet desires and propaganda however, there seems little evidence to support the proposition that the USSR has actively sought to interdict western oil supplies. Nevertheless, Soviet pro-nationalization policies and offers of technology were clearly aimed at diminishing the overwhelming western presence in the Middle East and did meet with some success, at least in the pre-1973 period. Analyzing the situation from a western viewpoint, it has to be appreciated that so long as western countries are heavily dependent on Middle East oil and the Soviet Union is not (a situation which we have suggested will obtain until at least 1990), any Soviet activity in the region which disturbs the status quo will appear as directed against disturbing the oil flow to the West (whether or not this is its primary aim). Likewise, any act which does hurt the West in this way *will* of

[33] Extensively documented in Kohler et al. pp. 69–85.
[34] A. Yodfat and M. Abir, *In the Direction of the Gulf,* London: Frank Cass & Co., 1977, p. 20.
[35] William B. Quandt, "Soviet Policy in the October Middle East War." *International Affairs,* July and October 1977.
[36] Golan, pp. 197–198.

course profit the USSR, whether or not this was its aim in instigating it.

A deterioration in relations between the USSR and the West would increase the chances that the Soviets would be motivated to act in such a way as to make the world oil supply situation more difficult for western countries. This is unlikely to take the form of overt military action, but could possibly involve Soviet manipulation of the oil it sells on the world market to exacerbate a tight world supply situation, or to switch deliveries to the spot market in order to take advantage of high prices. At present, the USSR would be unlikely to take such action because the majority of its oil sold for hard currency goes to Europe and Japan where the Soviets have built up a good trading relationship. However, in the event of concerted western economic and/or political sanctions against the USSR, the power of Soviet retaliatory actions should not be underestimated.

8. Oil Supplies and Soviet Intervention in the Energy Heartland—Toward a Likely Soviet Policy

From the analyses of the future Soviet and East European energy situation and the achievements of and possibilities for Soviet intervention in the Energy Heartland, it is now possible to comment on an optimum Soviet policy towards the region with respect to obtaining oil supplies required by CMEA countries. It should be noted that this is only one (and not necessarily the most important) aspect of the general Soviet policy of creating a sphere of interest in the Middle East at the expense of the West.

In the section on CMEA energy prospects it was concluded that the bloc could struggle along maintaining minimum oil requirements with an import of up to 50 million T/Y from outside sources in 1990, but that optimally (i.e., to promote East European economic growth and maintain Soviet oil exports to the hard currency area) imports would reach 125–150 million T/Y if non-hard currency terms could be negotiated. It was also established that these volumes would not be needed for the Soviets themselves but for Eastern Europe. With the likelihood that some oil will be forthcoming from countries other than those of the Middle East (i.e. Mexico), the requirements from the Energy Heartland are likely to be rather less than those quoted above.

Therefore, to speculate that the Soviets might indulge in adventures in the Energy Heartland (with all the attendant risks they would entail), it should be remembered that not only would this be entirely on behalf of Eastern Europe, but that minimum requirements only require annexation of 50 MTO. On the basis of these judgments it seems clear that if the Soviet Union were to engage in adventures in the Energy Heartland, this would not be in search of oil per se, although this would undoubtedly be a useful byproduct of any such successes. Nevertheless, prior to 1990 (and indeed as far as can be foreseen until the end of the century), it is simply not likely that the USSR would take risks such as would be involved in massive military action to secure greater access to oil for Eastern Europe without a much stronger energy imperative than has been foreseen in this study.

Even if the Soviets were to consider the risks of massive military intervention acceptable, there is no reason to think that their at-

tempts to seize and occupy oil fields and installations would be successful and much reason to think that these could fail, irrespective of U.S. reaction to any such activities. A Congressional Research Service study vividly spelled out these details at a time when comparable U.S. action was apparently contemplated.[37] Apart from assembling a sufficiently large force with suitable support facilities (probably easier for the USSR than for the U.S.), the major problems are the element of surprise—necessary because of the OPEC threat to destroy oil facilities rather than see them fall into foreign hands—and the vastness of the territory over which any invasion force would need to operate.

Although the geographic advantages of any Soviet action against the Persian Gulf would give a reasonable possibility of surprise, particularly if such action were to be aimed at countries contiguous to the USSR such as Iran and/or Iraq, the resistance that would be encountered would be extremely fierce in either case. This would almost certainly lead to widespread destruction of oil facilities which the Soviets, with their primitive technology, would find it difficult to repair, even if they could hold the territory.

In terms of the western and the regional reaction to such Soviet activity, one could speculate that this scenario is most likely to promote a military clash between the superpowers. Even if this could be avoided, it would almost certainly result in the regional countries requesting U.S. military protection of a kind that would witness a massive U.S. military presence in the Persian Gulf—something that the USSR has worked for years to avoid. Under these circumstances, we begin to draw a picture of the Persian Gulf carved up into Soviet and American zones, with all the internal conflicts in the region cross-cutting these alliances. The prospects for the security of any country's oil supplies under these conditions would be unimaginable.

The Soviet invasion of Afghanistan in late 1979 brought the whole question into very sharp focus. Neither country will have forgotten the incident in October 1973, when Soviet troop movements in the Middle East were perceived in Washington as being sufficiently threatening to put U.S. forces on a stage 3 alert.[38] This event in itself should have left no one in any doubt that the Energy Heartland is a region where a clash of the superpowers could escalate to a nuclear confrontation. President Carter issued a strong reminder of this situation in his January 1980 State of the Union Message: "An attempt by any outside force to gain control of the Gulf region will be regarded as an assault on the vital interests of the United States. It will be repelled by use of any means necessary including military force."

The Kremlin has, of course, strenuously denied that its actions in Afghanistan constitute any threat to the Gulf or its oil.[39] More interesting perhaps was the Soviet reaction to U.S. statements in 1973 and 1979 on the possibility of (U.S.) invasion of the region in order to secure oil supplies. Aside from the observation that this showed exactly

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[37] Oil Fields as Military Objectives: A feasibility Study. CRS, August 21, 1975. Also. John M. Collins and Clyde R. Mark, *Petroleum Imports from the Persian Gulf: Use of Armed Forces to Ensure Supplies.* Issue Brief No. IB 79046. CRS, July 24, 1979.

[38] Ray S. Cline, "Policy Without Intelligence." *Foreign Policy.* No. 17. Winter 1974/5, pp. 121–135. Also: Scott D. Sagan, Lessons of the Yom Kippur Alert. *Foreign Policy,* No. 36. Fall 1979. pp. 160–177.

[39] B. Rachkov, "Neft' i Zamicli Pentagona." *Ekonomicheskaya Gazetu,* August 1979. No. 35, p. 22.

how much the U.S. cared about human rights in other nations, Soviet commentary contained the strong undercurrent that the USSR would not stand by and watch the U.S. take over the Middle East.[40]

The fact that the superpowers, and particularly the U.S. have been prepared to spell out military intentions in the Energy Heartland, should leave nobody in any doubt as to the consequences of Soviet military invasion. This being the case and bolstered by the doubts expressed, concerning the prospects of success of any such action, it is likely that the Soviets will adopt a rather lower profile in the region.

9. Soviet Opportunistic Low Level Intervention Policies in the Energy Heartland

Without making some prediction about events in the Persian Gulf, it is impossible to comment on the scope of opportunistic activity for the Soviet Union over the next two decades. Nevertheless, the current situation in the region presents the Soviets with an immensely rich variety of possibilities which can be exploited, the most immediate of these being in Iran.

Iran serves as a perfect target for Soviet opportunistic actions, particularly in its fragmented and unstable political situation which seems likely to persist for some time. Aside from the country's resource wealth and strategic significance, the USSR has a strong national security interest regarding events in Iran, deriving from the long border between the countries. Although the Kremlin may have been equivocal about the demise of the Shah, particularly when replaced by so anti-Soviet a figure as Khomeini, these events gave the Soviets a number of opportunities which they did not have when the Shah was in power. The resurgence of different ethnic and nationality groups, which if armed and organized, could present problems for the central Government. Also the Iranian communist Tudeh party has a great deal more scope to operate, freed from the ferocious attentions of the Shah's secret police organization.

With the loosening of the power of central government, arms can be supplied to fringe groups which, although not necessarily pro-Soviet, need arms from whatever source. In addition, the Tudeh party can be built up to become a coherent, organized political force—possibly one of the few to exist if the Khomeini regime should fall. This is not to say that Iran will suddenly "turn communist" (or that if it did, such communism would be necessarily pro-Soviet), but simply that the USSR will be in a position to wield some influence in the country by encouraging destabilizing forces.

The emergence of any Soviet capability to promote instability in the region will be extremely important and will apply in a wider strategic threat which connects the peripheral countries—Afghanistan, Turkey, the Yemens, the Horn of Africa—to the oil producers, particularly the conservative monarchies. It has been noted that 1979 saw the beginnings of contact between the USSR and Saudi Arabia which may lead to diplomatic relations between the countries. It has been suggested that such action on the part of the Saudis may be a form of insurance policy, in the face of declining U.S. power and increased Soviet pres-

[40] Ilana Kass. *Soviet Involvement in the Middle East: Policy Formulation 1966–73*, Westview, 1978.

ence. The reasoning is that with the Soviets active in Afghanistan, the Yemens and the Horn; with instability in Turkey and Pakistan and Iran, there is a need to come to terms, or at least to open a channel of communication, with the USSR.

Following on from this, it is suggested that the Saudis might try to persuade the Soviets to desist from destabilizing activities in the region if some incentive were to be offered. Such an incentive might include deliveries of Saudi oil to Eastern Europe on favorable terms. This might be an interesting deal for the Saudis in that they do not need increased petrodollar revenues but desperately fear the regional instability which poses a threat to their regime. If they were to make some small volume of oil (say 25 million T/Y) available to CMEA countries in return for a Soviet commitment to regional stability and an undertaking to control its regional allies, this could be an immensely profitable arrangement for both sides. There would be the added advantage that if the Soviets were to break their undertaking, the flow of such oil could be immediately halted, causing hardship in Eastern Europe; thus there would be leverage from the Saudi side of the deal.

The problem with such an arrangement is that it would drastically curtail Soviet low level intervention activities, which have been characterized here as their most effective policy instrument in the region. Such an arrangement also drastically overrates the influence which the Soviet can exert over their regional allies. For these reasons the Kremlin is likely to favour continuing its policy of opportunism, as it leaves the policy makers with a free hand to deal with situations as they arise. This does not mean that the Soviets will not seek to cultivate closer relations with the Saudis and other conservative Gulf states, quite the reverse.

Soviet low level intervention is likely to be concentrated on Iran, Iraq and Libya. The reasons for selecting these three countries are: they are oil producing countries where the potential for substantial political instability is marked; they have anti-western (specifically anti-American) regimes, such that if discernibly pro-Soviet elements were to appear in the Government, there would be little that the West could do about this; oil production from any one of these countries would comfortably see the CMEA through the next two decades. This is not to say the Kremlin would not wish, and will not try, to promote instability in Kuwait or Saudi Arabia, but with the entrenched western interests in these countries and pro-western regimes which are super-sensitive to communist threat, such moves would greatly increase the risks of confrontation with the U.S., which the Kremlin can minimize by concentrating on other countries.

One other interesting insight may help to shape an impression of Soviet policy towards the Energy Heartland. A little publicized study which analyzes Soviet leadership attitudes toward the region through the various organs of the press—party (Pravda), state (Izvestia), trade union (Trud), military (Krasnaya Zvezda)—finds that the military press organ adopted a significantly more assertive attitude towards the Middle East.[41] The military newspaper continued to urge,

[41] Ibid., see especially, "Epilogue: The Soviet Military as the Chief Proponent of a Forward Policy in the Arab East." pp. 205–212.

in the late 1960's and early 1970's, that irrespective of the costs, the USSR should make every effort to maintain and bolster its position in Egypt and Syria; this at a time when the top leadership were apparently wavering in their resolve to continue such support. Although this assessment only considered the years up to the October 1973 War, it may be significant that the military have been observed in this light and correspondingly necessary to study the composition of the new leadership when it finally emerges, to see how far a military viewpoint may be reflected.

Finally, this section closes with an observation rather than a formal "conclusion." The situation in Iran presents the Kremlin with an opportunity such as they have not enjoyed for a considerable period of time (if ever in the history of the Soviet state) to capitalize on a situation in a way that would give them influence (perhaps presence) in a major oil-producing country of prime strategic importance. Also for the first time, the distinctly anti-western character of the Iranian regime means that the West could do little about such Soviet moves. The geographical proximity of the USSR to Iran greatly enhances this unique advantage. The success of the USSR to capitalize on this situation (which they did almost nothing to create) will say a great deal about their real intentions and capabilities in the Energy Heartland over the next two decades. If they are unable to make anything of this opportunity, Soviet policy in the Persian Gulf will have received the severest of setbacks.

10. Conclusions

In the coming two decades, the Soviet Union and Eastern Europe will be facing a difficult economic situation with reduced rates of growth, especially in the East European countries. One aspect of these economic difficulties will be the energy situation throughout the CMEA. This may be one of the most difficult problems that Eastern Europe has to face in the remainder of this century; for the USSR however, independence of imported fuels (for domestic consumption) is assured for at least the next ten and probably the next twenty years; the biggest problem will be fulfillment of its energy responsibilities in Eastern Europe. The short to medium term energy problems of the CMEA center on Soviet oil production; the long term situation, i.e., mid to late 1990's is dependent on the pace of development of nuclear power.

By 1985, it would greatly help the CMEA energy balance if up to 50 million T/Y of oil could be obtained from outside the region, primarily in the Energy Heartland. This quantity of oil is needed by Eastern Europe not only because the USSR (in the worst case of oil production) may be unable to supply their requirements, but because the Kremlin wishes to maintain exports of oil to the West in order to earn badly needed hard currency.

After 1985, the energy situation may become more difficult especially in the following five years if oil production falls rapidly. In a worst case situation, the CMEA might wish to import as much as 150 million T/Y by 1990, i.e., the entire East European requirement. There is no possibility of these countries purchasing this oil on straightforward cash terms because of their lack of hard currency and virtually

no possibility of them borrowing such large sums on the international market. At present, no OPEC country appears willing to export more than marginal quantities of oil to CMEA countries on anything other than hard currency terms. If the communist countries are unable to persuade oil producing countries to change their attitudes in this regard, CMEA imports are likely to be restricted to 5 million T/Y through the 1980's with adverse consequences for economic growth rates, especially in Eastern Europe. It must be stressed that this gloomy scenario *only* holds good in the case of rapidly falling Soviet oil production, an event that this writer does not consider likely.

Nevertheless, even in a situation where oil production holds at 650 million T/Y after 1985 there may be problems with economic growth rates, particularly in Eastern Europe.

The critical period for the CMEA energy balance will be 1985–90, when no amount of juggling with the energy balance will be able to obscure the fact that without increased quantities of oil, from whatever source, economic growth rates will be affected. It should be remembered, however, that the populations of communist countries have historically shown a high tolerance for economic deprivation and no study should be dogmatic about what these regimes will be "forced" to to do in the future. The political consequences of economic hardship are difficult to predict in relatively monolithic, authoritarian societies; much may depend on what is happening to their ideological adversaries in the West.

Beyond 1990, the picture is naturally more uncertain. Nevertheless, it seems likely that forward planning (by which is meant the ability of a centrally administered economy and an authoritarian policy to take and implement decisions with relatively little attention to dissenting groups and individuals in the society) could make it possible for the CMEA to reduce its oil dependence in the 1990's, by intensified development of fossil fuels and rapid increases in nuclear generating capacity.

The impression should not be formed that the energy future will be easy for the CMEA countries, especially in Eastern Europe. However, with clearsighted forward planning and investment, those countries appear to have a reasonable chance of remaining relatively energy-independent over the next two decades (that is, if East European dependence on the USSR is regarded as "independent"). The Soviet Union appears to be in a particularly favorable position in that even if domestic oil production should fall in the latter part of the 1980's, the country will remain completely autarchic in energy through 1990.

In terms of their influence on the world oil market, the judgment that the CMEA countries will remain relatively independent does not alter the fact that Eastern Europe will seek to achieve an optimum level of oil supplies, i.e., a situation in which those economies are not constrained by shortages of oil. Such a position would require significantly greater supplies of oil, particularly in the post-1985 period when the judgment that oil imports will remain at 50 million T/Y has been made in spite of the strenuous efforts that CMEA countries will undoubtedly be making to purchase oil on non-hard currency terms. In addition, the USSR will be extremely reluctant to give up exporting oil to the hard currency area and will attempt to prolong this trade by enticing OPEC and non-OPEC countries to satisfy at least a part of

East European and Cuban requirements. Increasingly, therefore, the CMEA countries will seek to carve out a piece of world oil supply for themselves in the mid-to-late 1980's.

The strong likelihood that they will not be successful in this endeavor springs from two factors: first that they will be approaching oil exporters to extend oil and/or credit on concessionary terms. Second, that world oil supplies are likely to become so tight that only countries offering the highest prices and/or the best technology can expect even to maintain their share of the world market, let alone create a share where none has existed before.

In the event that purely economic considerations do not favor the communist countries in their search for oil, the political and strategic considerations are more complicated. There is a school of thought that sees a "grand design" in Soviet strategic thinking to take over the entire Middle East in order to use its oil for Soviet purposes and deny the use of it to the Western World. This study has down-played such a view on the grounds that while such a desire may exist, Soviet progress toward it over the past two decades has been so modest that the Kremlin is undoubtedly concentrating on more limited objectives. A more extensive discussion of Soviet relations with the Middle East might center on the reasons why the Soviets have failed so dismally to consolidate the promising position that they enjoyed in the 1950's and 1960's.

However, despite a series of humiliating setbacks, most notably the expulsion from Egypt and lack of any real role in the Arab-Israeli peace process, as the 1970's drew to a close, the Soviets had begun to acquire some peripheral presence in the region. Once again, as in previous decades, this influence is concentrated in non-resource rich countries: Afghanistan, Yemen, Ethiopia, with unstable governments. The difference is that in the future, it will be necessary for the CMEA countries, principally represented by Eastern Europe but heavily backed by the USSR, to build links with OPEC countries in order to secure a modest supply of oil.

If, as has been suggested, such oil should not be forthcoming on a straightforward commercial basis, the Soviets may conceive a need to take action in order to make a regime or regimes in the region more politically amenable to the communist countries to facilitate access to oil. The likelihood that the Soviets will employ massive military forces in an invasion to secure a country's oil is not considered high, notwithstanding the Soviet invasion of Afghanistan. This judgment is based on the observation that the Soviets will not suddenly wake up and find themselves short of oil (rather as the West did in 1973). They have at least five years to prepare and explore all the contingencies and options that their energy situation allows.

Over those five years, they have the problem of helping their allies to find 50 million T/Y of oil; not a particularly large amount by western standards. Soviet energy tactics, both domestic and foreign, will evolve as it becomes clearer, year by year, just how serious the oil situation is and how difficult it will be to obtain the necessary supplies from outside the bloc. Foreign efforts and domestic stringencies can be stepped up, as and if the situation warrants. Thus from this perspective, invasion of oil producing countries, which has no certainty of success as far as capturing oil fields is concerned, is the

kind of desperate gamble that the Soviets would be unlikely, *and more importantly will not need*, to resort to, given a clear intention by the U.S. to use military force in defense of those countries.

Far more likely is that the Soviets will continue their current policy which is characterised by, ". . . adaptability, persistence and pragmatism as well as opportunism and low risk." [42] It is suggested that the approach of the Soviets will be one of low level intervention characterized by judicious (financial and military) support for dissident groups within countries where domestic political instability may give these groups an opportunity to attain power. The strongest candidate for such action at the present time is Iran, with Iraq and Libya also suggesting interesting possibilities.

Using a policy of low level intervention, the Soviets risk little retaliation from the West given ". . . the alacrity with which Washington sees a Russian behind the bush of any and all Third World revolutionary activities . . .," [43] for there is no level of response at which the U.S. can effectively operate since in most cases it is not possible to prove direct Soviet involvement. The Soviets naturally hope to make political and economic gains from this policy, but they will always be assured of the discomfiture of the West which will result from even the threat, let alone the actuality of interruptions in oil supplies.

It is in the vulnerability of the West to oil supply interruptions that the greatest Soviet power may lie. This is a situation that will endure for at least the next decade in terms of western vulnerability, and for at least the first five years of that decade (with the CMEA maintaining relative energy independence) the Kremlin will, on balance, benefit from such occurrences. Those who forecast that the Soviet Union is approaching an energy crisis, seldom link this to the fact that the West is already in an energy crisis. The Soviets have to worry about the next five to ten years; the West must concentrate in getting through the next five to ten months, or even weeks!

The overall impression is that the Soviets will adopt a "watching and waiting" game in the Energy Heartland, combining opportunist moves with low level subversive activities. The fact that this will not make the task of the West easier in obtaining the oil it needs, will not be as important as the obstacles that the Middle East countries themselves erect and the problems that western countries create for themselves by a combination of indecisive and inept domestic and foreign policies.

Undoubtedly, the attempted entry of the communist countries into the world oil market will make the world oil supply situation more difficult in the 1980's particularly after 1985. The CMEA countries will exert a strain on world oil supplies of at least 100 million tons in the late 1980's, compared with the current situation; 50 million tons that the Soviets will not be exporting and 50 million tons that Eastern Europe will be importing. The CMEA will therefore add to the problems of western countries in obtaining oil on world markets.

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[42] Alvin Z. Rubinstein., "The Soviet Union and the Arabian Peninsula." *World Today*, November 1979. pp. 442–452. also, "The Soviet Union and the Eastern Mediterranean." *Orbis*, Summer 1979.

[43] Mohammed Ayoob., "The Superpowers and Regional Stability: Parallel Responses to the Gulf and the Horn." *The World Today*. May 1979, pp. 197–205.

However, the real difficulty and the need to adapt to a changed situation, will rest with OPEC countries which will find themselves under pressure to supply the communist countries with oil and will need to find ways of countering Soviet advances—political and commercial, through Eastern Europe or other surrogates.

Those who expect the Soviet and East European entry into the world oil market to be the straw that breaks the camel's back, are almost certainly wrong. On present showing, the camel will have collapsed long before the communist countries make their appearance.

IV. SOVIET ECONOMIC POLICY TOWARD WEST EUROPE

By Ronda Bresnick and John P. Hardt*

1. Selective Modernization and "Interdependence"

The selective policy of economic interdependence adopted by Leonid Brezhnev and Alexei Kosygin modestly opened up the prospects for, not only increased commercial relations, but also an increased interrelatedness between the political economies of East and West. Modest as the quantitative shift from economic independence to independence has been, the implications of the changes have been significant: a new, long-term policy of importing selectively for access to priority high-technology Western products and processes; an export policy upgrading earning potential from material sales (including energy) in Western markets; a policy stressing nontrade income from the enhanced appeal of tourism from the West, shipping, and so on; and improved institutional links for promoting East-West commercial and financial facilities. All of these changes contributed to a moderate degree of exchange and interrelations. Perhaps most significant and symoblic of these relations in the 1960's and 1970's was the automative arrangements with Italy and the energy agreements with the Federal Republic of Germany.[1] The significance of the future developments is that a threshold of economic relations may be reached tying together the political economies of West and East Europe. The key to this trend is Soviet petroleum and natural gas supplies and export policy.

The Soviet leadership under Leonid Brezhnev gave special consideration to technology transfer and industrial cooperation with the West European economies in order effectively to stimulate modernization in the Soviet economy. This modernization process in energy output, automotive transport, petrochemical, metallurgical, and other industrial areas showed considerable promise for stimulating economic growth and improving output quality. However, Western inflation, which affected the prices of industrial products critical to import plans, and a reduction of demand in many of the nonenergy materials markets—resulting from the combination of inflation and recession in Western Europe—tended to retard efforts to carry out this element of the Soviet interdependence strategy. The levels of indebtedness or trade deficits that were financed by Western credits were therefore substantially widened.

In conflict with Brezhnev's policy of increased trade with Western Europe are high-priority, domestic resource-demanding, defense-sector interests. Some would argue that by increasing foreign trade, cer-

*Office of Senior Specialists, Congressional Research Service. Library of Congress.

[1] See especially John P. Hardt and Ronda A. Bresnick, "Brezhnev's European Economic Policy" in George Ginsburgs and Alvin Z. Rubinstein, *Soviet Foreign Policy Toward Western Europe*. New York : Praeger, 1978, pp. 200–231.

tain domestic resources would have to be diverted from domestic industries (including defense) to import-related activities. In order to be effective, high-technology imports must often place increased domestic investment demands on the Soviet economy.[2] These resource demands may be as high as two-to-one, for example, two rubles of incremental investment for each ruble value of imported Western equipment. The resource-demanding aspects for making Western technology transfer effective are additive to the diversion of high-quality products to export industries.[3] This cumulative resource-demanding process tends to be competitive with the number-one resource claimant, the Ministry of Defense Industries. Any significant increase in foreign trade that would divert large resources away from defense, therefore, does not seem likely in the short term. As it appears now, Brezhnev's appetite for high technology imports may continue to be moderated by Party's desire to maintain large resource commitments to defense. This firm commitment to maintain a heavy military burden thus may tend to frustrate Brezhnev's desire for increased economic relations with Western Europe.[4]

2. Energy Trade, Diplomacy, and Control

Sales of Soviet petroleum products and natural gas to Western Europe have shown promise to be the solution to most Soviet trade financing problems and to provide a potentially important economic lever for influence on West European governments. A retardation in the projected expansion of Soviet petroleum output and the increasing expense involved in expanding natural gas output for sale to Western Europe have made the energy solution more viable than earlier seemed possible. In addition, natural gas supply increases may make projected energy interdependence a reality.

The Brezhnev policy of economic exchange with Europe may be a long-term policy commitment. The balance sheet of benefits and costs, of leverages and linkages, will be influenced by the relative importance of Soviet energy supplies in the western market, the ability of East-West trade to flow relatively freely, the export potential of the USSR and the willingness of Western Europe to purchase Soviet goods. All of these elements of exchange place both the Western and Eastern partners in a position of mutual interdependence and leverage. Each may use some aspect of the new relationship for economic, political, and ideological gains and in many cases must incur the related costs from such linkage.

In considering Brezhnev's policy of measured economic interdependence with Western Europe, a number of questions and tentative assessments may be considered:

(1) If importation of Western technology is of critical importance to attaining Soviet objectives in modernization and improved con-

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[2] George Holliday, "The Role of Western Technology in the Soviet Economy" in Joint Economic Committee, *Issues in East-West Commercial Relations*, January 1979, p. 58.

[3] *Ibid.*

[4] John P. Hardt, "Soviet Economic Capabilities and Defense Resources" in the *Soviet Threat: Myth or Reality?* (New York: Academy of Political Science, 1978); John P. Hardt in R. Bauer, ed., *The Interaction of Economics and Foreign Policy* (Charlottesville: University of Virginia Press, 1975), pp. 48–83. John P. Hardt and George Holliday, "Technology Transfer and Change in the Soviet Economic System", in *Technology and Communist Culture: The Socio-Cultural Impact of Technology Transfer Under Socialism*, ed. Frederick Fleron (New York: Praeger Publishers, 1977).

sumer welfare, is this gain offset by increasing dependence on Western sources of supply and deepening reliance on the fluctuations and terms of the Western markets for goods and credits?

The policy of importation, illustrated by the German large diameter pipe for Soviet natural gas pipelines and the Volga automotive plant built on Italian FIAT design in the Soviet city of Tolgattigrad, the Kama River plant, and other projects, provide insights on and illustrates a long-term expanding commitment to a flow of Western technology and management techniques. Over time, the degree of dependence on the Western suppliers may be expected to increase. Is the cost of termination—in reduced Soviet orders to Western firms threatening significant numbers of Western jobs and production—an effective Soviet counter lever in negotiations with Western companies and governments on terms of credit and conditions of technology transfer?

(2) If export of Soviet materials, including oil and natural gas, provides necessary energy sources to West Eupropean countries, does this reliance provide important political linkage and leverage potentials for the USSR or is this gain offset by a critical need for Western technology and credit to expand output of those same Soviet supplies of oil and gas.

The continued expansion of Western technology imports financed by exports of manufactured goods might make the Soviet Union more susceptible to the adverse effects of Western inflation and recession in manufactured goods trade. As a result, they might occupy the role of the developing part of a dual economy or a depressed area in a Western economy—that is, first to be dropped from demand and most sensitive to price rises and last to benefit from price stability and economic expansion. On the other hand, the Soviet Union might benefit from western inflation, indeed the Soviets have received a balance of payments bonanza from the OPEC oil price increases of the 1970's.

(3) If CMEA countries become more integrated with the Soviet economy, providing investment and labor force for projects such as the Orenburg gas pipeline, is this to be at the expense of growth-generating East European relations with the West? Will the commitment of East European, high-priority "hard goods" to these joint projects be economically destabilizing for some of the domestic economies of Eastern Europe, requiring hard-currency imports from the USSR, to maintain political and economic order?

Soviet economic policy within CMEA must steer a narrow course between minimizing the costs of exporting "hard" goods, such as petroleum, to its CMEA partners and maximizing the benefits of importing "hard" goods from them. By manipulating the Soviets' economic cost benefit relationship with CMEA, the Soviets may increase integration within Eastern Europe and retain strong leverage over the Eastern European leaders. In poor-performance years due to domestic economic problems, poor weather, and foreign trade problems, the pressures on Soviet leaders to minimize their economic costs within CMEA will be greater. It appears that Orenburg type joint energy projects are not to be the pattern of the future as the Soviet Union tightens the CMEA energy belt.

At the same time increasing East European reliance on Soviet oil and gas gives the Moscow planners a lever for influencing East Euro-

pean plans. Currently they plan severe austerity for East Europe with a very limited energy ration, i.e. Soviet deliveries for 19818–85 will not increase.[5] For importing more oil from OPEC for expanding energy needs the East European countries will have to earn hard, convertible currency in West Europe or the Middle East. Soviet needs for financing technology imports may, in turn, influence their policy toward events in Poland and elsewhere in East Europe.

(4) If the importation of Western technology is key to Brezhnev's economic policy, will the Soviet leadership find it necessary to divert domestic resources away from the defense sector in order to finance such trade and effectively utilize the imports? Indeed if increased trade is a common denominator in East-West relations, and if Brezhnev's desire for increased trade is not successful, what will East-West relations be like in the future? Without a substantial increase in domestic investment for building an effective infrastructure, the use of Western technology, especially in Siberian energy projects, will likely fall far short of its potential effectiveness. Substantial increases in domestic investment—particularly high-quality capital resources—in any large-scale volume raise the question of diversion from military programs. If the Soviet Union were to opt for a shift in their "guns and butter" priorities, the East Europeans, with less stake in global power balances, would be inclined to more than follow suit.

Brezhnev's policy of a degree of economic interdependence with Western Europe has gradually moved ahead. By and large, the net gains appear to be economic and the potential costs appear to be political, on both sides. What the exchange rate is in this calculus for Brezhnev or how his successors will view it is difficult to determine.

3. Energy Policy Equivocation in Moscow?

In the tenth five-year plan(1976–80), the first plan in the fifteen-year-plan, there appeared to be major equivocation in the application of the new Brezhnev modernization strategy, especially as it involves Western technology transfer. Serious delays in the plan for modernization were costly to future Soviet economic performance, specifically: delays in (1) projected production of Western autos and trucks in the USSR; (2) development of the power-consuming industries and resource-development industries in East Siberia and the region around the Baikal-Amur railroad; (3) the development of the agribusiness complexes required for modernizing the feed grain-livestock industry; (4) the development of long-distance alternating and direct current (AC and DC) transmission facilities for bringing cheap hydro and coal-generated power from Siberia to European Russian markets; (5) importing transmission, exploration, extraction, and other facilities for petroleum and natural gas complexes to meet the projected plan of output increases both onshore and offshore; (6) the Kursk metallurgical project for pelletizing and direct metal reduction and other metallurgy facilities; and (7) the introduction of an effective, computer-assisted national economic reporting system.[6]

[5] Based in part on discussions in Moscow, December 1980. Yu. A. Pekshev, Dolgosrochnive tselevie programmi sotrudnichetva stran-chlenov SEV (Long Term Targets for the Program of Cooperation of the Member Counties of CMEA). "Science", Moscow, November, 1980.

[6] John P. Hardt. "Soviet Economic Capabilities and Defense Resources" in The Soviet Threat: Myth of Reality? (New York: Academy of Political Science, 1978).

One likely reason for the delays may have been dispute within Soviet leadership on the economic priority of these specific projects, especially as it involved increased imports from their primary trading area, Western Europe, based on credit or industrial cooperation. These differences may have caused equivocation on the part of Brezhnev. Another reservation may have been the unwillingness to divert domestic resources from the military to effectively utilize imports at a time when military shares of resources were increasing.

The Guidelines of the Eleventh Five Year Plan (1981–85) appear to continue the general policy of equivocation. However, some of the energy related projects seem to have received enhanced priority:

(1) Petroleum exploration and extraction are to be emphasized so that planned production in 1985 will not fall below the 1980 level; rising modestly to 625–640 million metric tons from just over 600 million tons in 1980 (from about 12 to close to 13 million barrels per day).

(2) Natural gas output is planned to increase by up to 47 percent due, in large part, to the projected completion of the Northern (Yamberg) gas pipeline from the West Siberian Artic Circle to West Europe.

(3) Increased use of long distant transmission to bring coal and hydro generated electric power into the national grid is planned.[7]

The energy policy equivocation threatens to undermine Soviet energy expert policy so important to its economic health and effective diplomacy. The Soviet Union has been a net exporter of oil since 1955 and a net exporter of natural gas since 1970.[8] In recent years, oil and oil product exports have become the largest single earner of hard currency, bringing in over $10 billion in 1980. In 1980, natural gas exports have also become a major source of hard currency. For this reason, the energy sector will be in the best position to compete with the defense sector for scarce investment resources and hard currency for Western technology.

Because of the global demand and inflation of oil prices in 1973 and 1974, the USSR was able to finance a large share of high-priority imports with energy exports. It will likely continue to be a net energy exporter to the West throughout the 1980s to earn hard currency and finance imports unless the "worst" case output scenario proves true. It is estimated that out of a total of 135 million metric tons of oil (2.7 million barrels per day) available for export in 1980, the Soviets exported close to 80 million metric tons to Eastern Europe and over 35 million metric tons to hard-currency countries; and out of the 59 billion cubic meters of gas available for export in 1980, 33 billion cubic meters were to be exported to Eastern Europe and 26 billion cubic meters to Western Europe.[9] This represents a considerable increase for both East and West Europe in oil and gas in the 1970s and is the major share of Soviet hydrocarbon exports (see table 1).

Third World, East European, and West European energy sales of petroleum may be considered alternative export options for the Soviet Union. Supply of some 16 million metric tons of petroleum to Cuba may be contrasted with hard currency sales to West Europe and Japan. Japan imported 36 and 14 thousand barrels per day in 1970 and 1978, respectively.[10] What is gained politically or diplomatically

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[7] Pravda, December 2, 1980.
[8] National Foreign Assessment Center. *International Energy Statistical Review.* 25 November 1980, ER 1EST 80–015 CIA, pp. 25, 28.
[9] *Supra.*
[10] *Op. cit.*

from "soft" currency sales must be balanced against the "hard" currency income benefits of sales to West Europe and Japan.

Possibly a trade off in hard currency sales of oil is the supply to countries such as Cuba for sugar or soft currency in maintaining the economic viability of an ally or soft currency sales to India, Brazil, Morroco, or Ghana to facilitate various diplomatic ventures with these neutral or independent nations. If we assume a very short supply of oil for their own needs, East European, and hard currency sales the USSR might be hard put to allocate even small exports to facilitate their critical diplomatic needs.

In many cases these sales are tied to modest imports by the USSR from oil providing countries such as Iraq. In these instances imports may be directed to export needs. More complex is a set of offsetting arrangements where the Soviet Union meets Third World needs of oil from other source countries to offset shipment requirements, e.g., Venezuela sells to Spain and the USSR supplies Cuba, but the oil actually goes the shorter distances from the USSR to Spain and Venezuela to Cuba in order to save transport. These arrangements require a certain degree of accommodations of relations between the USSR and countries with which they have limited diplomatic relations.

TABLE, I.—U.S.S.R. EXPORTS OF OIL AND GAS, SELECTED COUNTRIES[1]

	1970 oil/gas	1978 oil/gas
West Europe	682/0.1	1,025/1.8
Finland	188/---	195/.1
France	52/---	104/.2
Italy	217/---	172/.5
Netherlands	14/---	53/.7
Sweden	99/---	86/---
Federal Republic of Germany	115/---	178/.7
Austria	---/.1	---/.3
Greece	20/---	47/---
East Europe	805/.2	1,490/1.8
Third World:		
Cuba	120/---	190/---
Egypt	30/---	Negligible
Ghana	10/---	5/---
Morocco	14/---	12/---
India	5/---	60/---
Brazil	---/---	20/---

[1] Oil in thousand barrels per day, gas in cubic feet per day. National Foreign Assessment Center, "International Energy Statistical Review," Nov. 25, 1980, ER 1ESR 80-015 CIA, pp. 25, 28.,

In order to maintain energy exports as a major hard-currency earner, the Soviets must produce or import significantly more pipelines, compressors, drilling equipment, submersible pumps, and other geophysical equipment. Without this equipment and technology, exploration and extraction increases are not apt to keep up with energy demand. Therefore, the energy sector, must also lay claim to hard-currency imports to pay for imported energy equipment.

Compensation agreements with the West are perhaps one of the best arrangements for the Soviets to import Western technology and develop resources as they often do not involve complex financing arrangement but rely on barter with repayment through export of the product resulting from the agreed project. Tyumen gas, Yakutia gas, Sakhalin oil, and Orenburg gas are examples of the compensation agreements proposed or adopted with Germany, Japan, and within CMEA. In all

cases the Soviets sought to commit future energy production for current purchases of energy services, equipment, and technology. For future East-West trade, the Soviets have indicated a strong preference for this type of agreement. The risk and leverage balance in this type of arrangement also favors the Soviet side. The Western partners provide a fixed investment that cannot be effectively recalled once in place. The Soviet side compensates or pays back with supplies needed in the West, e.g., gas, over many years, through an interruptable supply arrangement subject to the risk of renegotiation or abrogation of contract.

The size of current oil exports to the West might be, to a large extent, a function of the attainment of the 1981–85 Soviet oil production goals. Should, for example, the 1985 goal of from 625 to 640 MMT or 12.4–12.9 MBD be significantly underfulfilled, the Soviets might cut back on oil exports to the West. Or the Soviets may choose to reduce domestic, CMEA, or Third World supplies.

The Soviets also export energy through sale of energy intensive products, e.g., refined copper. Those products which utilize large quantities of energy in their production processes are said to "embody energy." The Soviets, therefore, have options when developing their energy export industries, to export the raw materials—oil, gas, and coal—or to export those products that "embody energy", such as mineral fertilizers, copper, and aluminum. Because the products can utilize cheap and available energy resources, such as thermal power, hydropower, and natural gas, they serve three useful purposes to the Soviets. First, developing these industries contributes to the modernization process as it encourages the energy centers of East Siberia, where much of the natural gas and cheap hydropower is located, to be further developed. Second, utilizing a relatively small labor force, the production process for these embodied products overcomes much of the high-cost infrastructure development required for the development of other raw materials. And third, by developing an exportable product, the Soviets are able both to reduce their dependence on oil and gas exports and to help finance their trade with the Western nations. The demand for energy-embodied products does exist in some Western countries, because with large energy deficits these countries are looking for ways to cut energy imports for energy intensive production and processes.

The Soviets have, in their view, been economically supportive of Eastern Europe at a high cost to their own economic welfare. When the Soviets export energy to the Eastern countries they largely "lose" the full potential hard currency income that might have been earned had they exported the energy to Western Europe. In 1975, the Soviets might have earned approximately $5.25 billion by selling oil to hard-currency countries instead of to Eastern Europe; the comparable figure in 1980 would be over $11 billion. The Soviets maintain a high level of energy exports to Eastern Europe presumably because of their interest in East European economic performance and because it gives them a strong hold over the political and economic decisions made in those countries. East Europeans generally have a different view; considering the energy trade necessary, possibly onerous, but not preferential.

Although the Soviets—from a desire to increase energy exports to hard-currency countries—have encouraged the Eastern European

countries to arrange with the Middle East countries for energy in exchange for goods and services, no major deals have been made. The Middle East nations generally prefer to exchange their oil for hard currency rather than make barter arrangements, but the Eastern European countries have very little hard currency available for purchasing of oil. Therefore, it does not appear that the Middle East will contribute heavily to Eastern Europe's supply of energy for commercial reasons. However a combination of political-security and economic pressures may encourage more OPEC-East European energy trade.[11]

The Soviet leadership, in a continued effort to earn more from energy exports, has raised the price the East European nations must pay for their oil and gas. Although prices have not yet been raised to the world market level, starting in 1975 the East European nations were placed on a multiyear moving average to world market prices, which will draw them closer in time to Organization of Petroleum Exporting Countries (OPEC) pricing levels. Still, as soft or non-marketable goods by Western standards are still accepted in payment, the returns to the USSR are less than price equivalents would suggest.[12] On the other hand, prices for East European exports and other considerations tend to offset price differentials. Oil and gas prices will continue to rise, but because of the Soviet policy to maintain economic order and control over Eastern Europe, they will likely not rise enough to cause permanent economic damage in East Europe and will probably continue to be formally less than world market prices.

4. Energy Diplomacy and Finlandization of Europe

The Soviet influence on Finland has become a standard warning signal for measuring expanding Soviet political influence in Europe. This is cited as a reason for the delay in establishment of trade links between Finland and the nine-nation Common Market. With reduced U.S. security involvement and increased Soviet economic penetration in Europe, some perceive the political and diplomatic influence of the USSR to be greatly enhanced. The extension of Soviet gas lines from the Soviet border areas to France in the 1980s may make an economically unified Gaullist-type Europe "from Brest to Brest" a reality, but with the dominant role played by Moscow rather than Paris or other Western European capitals. As viewed by some, the economic leverage of the Soviet Union might at some point be used to encourage the removal of all Western export controls and to influence the extension of Western preferential credits and other trade concessions. Coupled with the preceived shift in the military balance to the Warsaw Pact, this trend might lead to Soviet dominance of Europe.

On the other hand, there is a view of Finlandization that stresses the increasing independence of the Eastern European countries and bordering states, such as the Scandinavian countries, that are exposed to direct Soviet pressure and to the increasing national and parliamentary nature of the West European Communist parties that are reversing the pattern of dominance by Moscow. A Swedish view of

[11] Stern. Chapter III, *supra.*
[12] See, Martin Kohn and Raymond Dietz in *Soviet Economy in a Time of Change.* JEC, 1979.

Finlandization stresses the increase of samll-country independence from the Soviet Union and the enhancement of national sovereignty:

> Finlandization means, for Finland, something far more positive than the interpretation used in the Western security policy debate. It means that the country, after an unsuccessful war, after reparations of a size which relatively speaking so far lacks any counterpart in modern history, by and by has succeeded in establishing relations with her powerful and victorious neighbor which has made it possible for the small country [in a different manner than] all other neighbouring states inside the Soviet sphere of interest, to preserve the traditional democratic political system, the free capitalist market economic system, and the possibilities of relations, cultural, economic, and in most other respects, with the environment. As a crowning decoration of this structure Finland has managed to get this policy of neutrality. The Finnish arguments on which this policy of neutrality is built have been explained in various ways and in fact on the whole followed the type of arguments prevailing in the debate on neutrality in Sweden.[13]

Current Soviet economic control centers around efforts to integrate further the economies of CMEA with the USSR as illustrated by the greater number and greater scale of joint projects primarily in the USSR, increasing intra-CMEA trade, and the increasing integrated effect of the Soviet energy policy—for example, the Orenburg gas pipeline, Kursk metallurgy combine, and the all European energy grid. With rising energy prices, greater demands may be made on East European leaders for conformity in economic policy, and the changing terms of trade may tend to tie the CMEA countries closer to the Soviet economy.

However, concurrent with this movement toward increased integration are efforts by Soviet policy makers to modernize the economy and increase consumer welfare—a policy based on expanding Western economic relations. It is this Soviet need to expand Western economic relations that permits greater East European exposure to and involvement with Western economic institutions. Prospects for continued involvements are reinforced by the Eastern acceptance of Basket Two of the Helsinki Final Act on economic, scientific, and cultural relations. However the Eastern and Western interpretations of the language in the Final Act differs. The principles adopted in the Final Act on "sovereign equality"—"respect of the rights inherent in sovereignty" coupled with the principle adopted by Warsaw Pact and CMEA nations of "mutually advantageous cooperation"—provide a range for independent individual East European action that could still be defined as within Soviet-approved guidelines. The leaders of the member states of the Warsaw Treaty Organization, meeting for a conference of the Political Consultative Committee in Bucharest on November 25–26, 1976, discussed questions concerning the prevention of war, a deepening of the relaxation of international tension, and the struggle for strengthening security and developing mutually beneficial cooperation in Europe. They pointed out that the period following the CSCE bears out the positive significance of the results of the conference and the commitments undertaken by its participants under the final act. To expect the individual countries to accept a "profoundly Western orientation" of the agreement is beyond the permitted parameters of the Soviet party line, but the area for economic sovereignty or individual country action appears to have been

[13] *Op. cit.*, Rubenstein and Ginsburg.

widened, both in practice and in principle, especially in Poland and Hungary. In the specific sections of Basket Two of the final act, the terminology is subject to different interpretations e.g. in "Business Contracts and Facilities"; "Economic and Commercial Information"; "Industrial Cooperation"; and "Arbitration and Other Institutional Arrangements".

In the original Helsinki Final Act there was a Soviet proposal for an all-European energy conference that did not meet. At the Madrid meeting in 1980–81 the Soviets again proposed a high level all-European energy meeting to be held under the auspices of the U.N. Economic Commission for Europe. This would be a forum for obtaining insights on Soviet energy prospects and plans as well as those of other signatory nations. It would also be a potential forum for forging greater Western unity or creating greater division in European energy policy: unity if the United States and West Europe agree on the form and substance of the meeting; considerable division if the United States were odd man out of the meeting and its preparatory process. In any event, if an all European energy conference meets after the Madrid CSCE session in 1981, differences in Western and Eastern perceptions will emerge again and be magnified. There may also continue to be differences between the United States and West European countries, as the U.S. has taken the lead at Madrid in opposing an all-European energy meeting or a high-level session on energy in the European Commission for Europe.

For every change in Soviet policy toward the United States and the West the smaller Eastern nations may be willing, and politically able, to take steps of substantially greater magnitude: The Soviets agree on a trade center in principle, and a trade center is opened in Warsaw; the Soviets consider industrial cooperation, and the Romanians change their investment laws to permit joint ventures; the Soviets discuss membership in the General Agreement on Trade and Tariffs (GATT) behind the scenes, and Romania, Hungary, and Poland apply for membership; and so forth. Whether a step backward by the Soviet Union would be followed by two steps backward by Eastern European nations is not testable at this time, but appears doubtful. Cooperation in energy or other fields may thus find the Soviet Union and other East European countries in general agreement but with variations from a common view. However, forward movement in Eastern Europe would probably be arrested, if not set back by a reversal of the Soviet commercial policy of normalization. The principle of two East European steps in compliance with Western commercial conditions to one Soviet step is applied unevenly. In need of technology and credit at various times, Romania, Poland, and Hungary have taken broad interpretations of the Soviet requirements for compliance to the Eastern guidelines. Hungarian acceptance of the 1974 Jackson-Vanik amendment linking credit and MFN to emigration, Polish promulgation of an investment law, Romanian adoption of liberal forms of industrial cooperation would not be evidence of opposition to Soviet policy under these circumstances but, rather, would be illustrations of the wider range of acceptable choices possible under the Soviet Western technology import policy and the Eastern version of the Helsinki Final Act conditions. The political implications of this diversity would have to be weighed against the economic advantages of measured increases in East Europe sovereignty and economic interdependence.

The end of autarky or economic isolation in the commercial trade of the Eastern countries with the West leads in time to a degree of interdependence difficult or costly to reverse. Some Soviet commentators suggest that a failure of detente would mean more than a return to a status quo ante—that is, they feel that relations would be worse. Most analysts agree that the costs of undoing this measure of interdependence would likely be greater than the initial costs to date. An assessment of the reversibility of change in commercial policy is certainly important to any Western decision on the risks of investments in East-West trade. West and East European economic interrelations are far more developed than the trade of the United States with the East. Indeed imports from the FRG to the Soviet Union and East Europe in 1979 were roughly equivalent to those of the FRG to the United States, around $11 billion, if the GDR is considered part of the East.[14] This illustrates how much further East-West relations have developed within Europe than with North America.

The dominance of Soviet policy in Eastern Europe is likely to remain a major constraining factor in CMEA-West European trade. The continued maintenance of overwhelming political, military, and economic leverage in the hands of Moscow's decisionmakers is likely to circumscribe independent Eastern European foreign security policy actions. The Soviet Union, on the other hand is likely to be influenced in restraining this polycentrism and pluralism in East European relations by their relations with the other world power centers—the United States, Western Europe, Japan, and the People's Republic of China.

The two views of Finlandization indicate some of the limits to change in Western Europe. The industrial nations of Western Europe may become more dependent on Soviet raw materials, including energy, but the Soviet Union and all of CMEA may, at the same time, become increasingly reliant on West European technology. Likewise, Warsaw Pact forces seem likely to remain stronger than NATO in Europe. At the same time, the increasing China threat and the continued U.S. nuclear umbrellas in Europe and Asia may offset the European security factors favoring the East in the global confrontation.

All these factors of economic interrelations, security issues and energy policy combine in deliberations on a single natural gas project, the Northern pipeline from the Taz peninsula to Western Europe; therefore, we shall discuss this project in more detail.

5. The New Pipeline as the East-West Economic Linchpin[15]

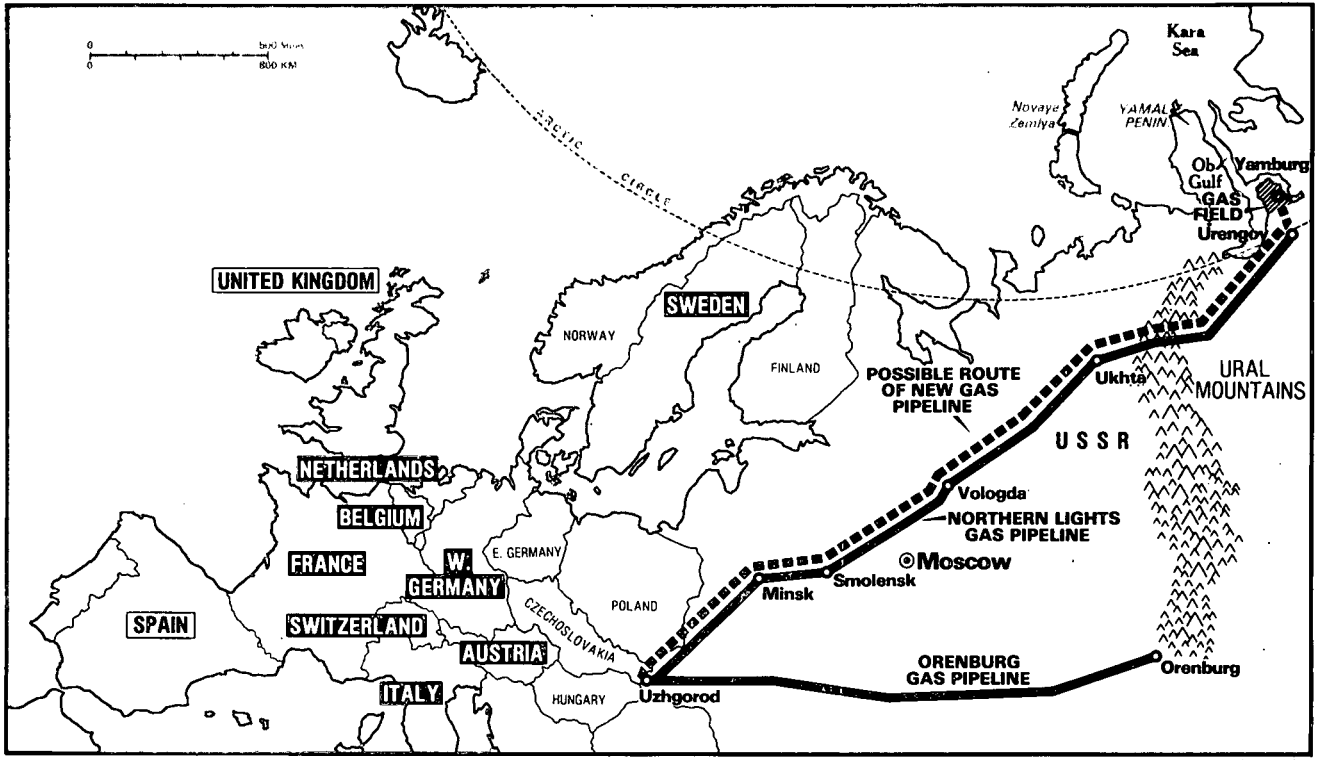
The Northern natural gas pipeline from the Yamburg field on the Taz peninsula, is to provide a significant increase in Soviet energy sales to West Europe in the 1980s largely on the basis of Western financing (see figure 1). The pipeline is described by some Soviets as "the largest project in recorded history." With some allowance for hyperbole the significance of the project may be illustrated by the following data:

[14] Bureau of Intelligence and Research, Department of State, *Trade of European NATO Countries with Communist Countries*, 1980.

[15] Although popularly referred to as Yamal, Yamburg is East of the Gulf of the Ob River on the Taz not the Yamal Peninsula. Much of the information came from interviews in Moscow, Frankfurt, and Bonn in December 1980. See also *Financial Times*, December 16, 1980 and March 16, 1981; *Business Week*, December 19, 1980, pp. 40, 44; *Business and Trade* newsletter, November 1, 1980, p. 1; *New York Times*, January 11, 1981, p. 5 and April 19, 1981; *Wall Street Journal*, January 23, 1981, p. 1.

Figure 1.

POSSIBLE ROUTE OF YAMBURG GAS TRANSMISSION SYSTEM



Source: The Chase Trade Information Corporation

Energy Supply

By the mid to late 1980s from 40 to 70 billion cubic meters of additional gas per year would be flowing to West Europe (about 4 to 7 billion cubic feet a day). This would flow through one or two parallel lines accounting for the 40 to 70 billion cubic meter range at 75 atmospheres pressure (ATA). One line at 100 ATA has been discussed but would be experimental and risky as no line of 100 ATA pressure has been used to date. Some of the gas may come from the more developed Urengoi fields in Arctic West Siberia.

This new pipeline would provide additional gas for ten European countries: Federal Republic of Germany, Italy, Austria, France, Belgium, Switzerland, Netherlands, Sweden, Finland, and Greece. Five of these countries would be receiving gas from the U.S.S.R. for the first time.[16] All would significantly increase their gas imports. The share of Soviet gas in the gas consumption of the FRG would increase from just under 20 percent to 30 percent or more in 1990. This would represent an increase of Soviet gas in the share of primary energy from about three to six percent for the FRG. France and Italy in 1990 would have a similar share of their gas imports from the Soviet Union and it would represent about 6 percent of their energy balances. In Austria the share in gas imported and primary energy would be substantially higher, possibly as much as 18 percent of their primary energy in 1990.

The fall of the Shah aggravated the energy supply problems of the Soviet Union, East Europe and the FRG. The new pipeline would not fully offset the Iranian supply loss to the FRG. By way of comparison, it may be noted that German imports of natural gas under the large projected deal, the trilateral gas swap agreement discussed among Iran, the USSR and the FRG in 1975, were expected to account for about 9 percent of the FRG's natural gas consumption in 1985. The deal which was abrogated in the summer of 1979, would have provided the FRG with 5.5 billion cubic meters of gas annually, starting in 1983.[17] The projected FRG consumption of Soviet gas is 12 to 15 billion cubic meters in 1985. Not only are Iranian gas deliveries from the projected line (IGAT II), which was discussed in 1975–79, not likely under the current Iranian government, but deliveries to the USSR under their old agreement (IGAI I) have been interrupted, possibly terminated. The FRG authorities talk about other Middle East gas supplies, e.g., Algeria, but Iranian supply prospects for any future time are considered very conjectural.

Financing

Final terms and agreements had not been reached by the end of May 1981. Estimates in December 1980 by informed financial circles placed the anticipated total Western financing at about $15 billion.[18] France provisionally led the financing discussions on a 15 billion French franc loan in December 1980 that was not finalized. Some argued that early French agreement was to be used as a bargaining lever with other financing countries, namely the FRG.

[16] See table 11, above.

[17] Cited in Carl McMillan and John Hannigan, "Joint Investment in Resource Development: Sectoral Approaches to Socialist Integration", in Joint Economic Committee, *East European Economic Assessment, Part 2.* (Washington, U.S. Govt. Print. Off., 1981.)

[18] In private discussions some European sources indicated total cost might rise to as high as 60–80 billion Deutsche marks, ($30–40 billion) presumably including Soviet outlays. A German estimate in March 1981 was 20 billion DM. *Financial Times,* March 16, 1981.

Most of the West European importers of gas and exporters of pipe and equipment would participate in the financing, as well as Japan. The FRG, the lead financing country, will probably provide the largest share of credit. The amount of government credit and credit guarantees as well as the terms of repayment is to be worked out. Issues such as grace periods, interest rates—floating or fixed—government guarantees, are all part of the negotiations. The effect of this one project would be a significant short term increase in Soviet hard currency debt and possibly rise in their debt service ratio. The Soviets would prefer to have the following terms: repayment beginning with gas flow so that gas exports over a decade would finance the loans, provision of a share of gas for sale to West Europe and East Europe from opening of the line, pricing of gas tied to OPEC oil pricing, and loans in Western government-backed credit and credit guarantees. The Soviets believe that construction would take three to four years, so a grace period of that length would meet their optimum needs. This time period helps explain the 47 percent increase in Soviet gas output projected in the Eleventh Five Year Plan (1981–85).[19] It has been estimated that natural gas export earnings would increase from about $1.5 billion currently to a much higher figure in 1985.[20] The combined oil and gas earnings of some $13 billion in 1980 are composed of $11.5 billion from oil, $1.5 billion from gas. The relationship may be changed with gas possibly the larger source of hard currency in the late 1980s with the total income from oil and gas sales likely rising. The completion of the new gas pipeline would have to precede emergence of gas as the major hard currency earner, replacing oil.

Trade Implications

Sales of transmission pipe, compressors and other related equipment would follow financing of the Yamburg pipeline. The FRG would be the major supplier of pipe from a group of manufacturers with the German firm Mannesman leading. Ruhrgas A.G. would lead a group of West European gas distributors. Equipment sales tied to government financing and coordinated commercial bank financing would thus favor Germany. Japan by joining the financing would expect some pipe and equipment sales. Even without financial participation some U.S. companies expect sales: Cooper Industries (compressors), Caterpillar (pipe laying equipment), Solar Division of International Harvester, and General Electric. General Electric apparently has key patents that would likely tie them directly or indirectly into turbine sales. Other American companies may deal indirectly through European suppliers.[21]

The income to the USSR from gas sales might more than compensate for the lack of increases in hard currency income from oil sales. As noted above, hard currency income from petroleum has been running at about $10 billion a year. Future gas sales may eventually be

[19] *Pravda*, Dec. 2, 1981.
[20] *Financial Times*, Dec. 16, 1980.
[21] Miles Kostick and Marc Millot of the Institute of Strategic Trade, have recommended canceling of export licenses related to U.S. company participating in pipeline for overriding national security reasons. "Soviet Gas Deal and Its Threat to the West," Dec. 31, 1980, mimeo, 24 pages; *Washington Post*, January 1981; See also Op. Ed., *New York Times*, February 12, 1981. See also "Caterpillar Gets $40 Million Soviet Order, Giving White House a Political Dilemma", *Wall Street Journal*, Feb. 17, 1981, p. 12.

substantially higher. The Soviets may continue oil sales, albeit at a lower volume, benefiting from rising prices.[22] They may vary their sales in reference to their balance of payments needs and oil supply conditions.

Mutual dependence of the trading partners, the various aspects of Finlandization, are raised by the Yamburg project. The Soviet Union may use gas supply and pricing as a tool in diplomacy. Likewise West European nations may use sales of equipment, technology and credit as levers in their relations with the USSR. A presumption of greater Soviet short term leverage is based on the view that a significant interruption of gas supply may have more immediate effect than a similar shut off of equipment sales or loans. This short term effect might be cushioned by the existence of alternative energy sources and/or ability of West European countries to sustain economic growth with some energy supply shortfalls. In German discussions there seems to be some difference of view on the measure of impact from potential gas shutoff. Chancellor Schmidt is also said to view an agreement on Yamburg as a "stabilizing factor" in East-West relations.[23] Many of the leaders of Western countries argue that, not only is there a plurality of interests among the Western industrial nations, but quite different economic requirements. In energy they would especially note the absence of any possibility of Western European energy independence, requiring a reliance on diversity of sources for energy supply security.

Europeans might also argue that Yamburg, the European version of the earlier Northern Star proposal promoted by Richard Nixon and Peter Peterson in 1972–74, is a much sounder credit risk and more secure source of supply than "North Star" would have been to the U.S.[24] The cost to the Soviet Union of not meeting repayments or delivery commitments from Yamburg would be substantial. Examination of the Eleventh Five Year Plan (1981–85) may illustrate how reliant the USSR now is on a continuing and expanding supply of technology and equipment from the West. These technology imports can not be repaid by export earnings from non-energy exports and oil sales, so expanded gas sales and Western credit facilities will continue to be crucial to trade with the West. The Soviet Union might, at any point, risk the cost of technology trade and credit cutoff and the attendant increase in the economic and political costs by gas delivery cutoffs or a credit default. The question is would the cost of that action be too high as viewed by Soviet leaders?

Some argue, however, that the equipment exports have been so important to West European jobs and production that even a major political-military crisis, such as a Soviet invasion of Poland, would not reverse economic *Ostpolitik*. In this vein it is argued that European technology and credit would be available to the USSR under a variety of adverse scenarios from a West European viewpoint. A Soviet default or invasion of Poland would seem to us as too heavy a

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[22] "Soviets Are Cutting Their Oil Deliveries to Western Europe", *Wall Street Journal*, Feb. 9, 1981, p. 21.

[23] John Vinocur, "Reagan and Europe," *New York Times*, Feb. 11, 1981, p. 1.

[24] Senate, Foreign Relations Committee, John P. Hardt, George Holliday and Young C. Kim, *Western Investment in Communist Countries*, GPO, 1974. House Foreign Relations Committee, John P. Hardt and George Holliday, *US-USSR Commercial Relations: The Interplay of Trade, Technology and Diplomacy*, GPO, 1973.

burden to be sustained by economic Ostpolitik, but a lesser crisis might not.

We earlier argued that the principle problem in assessing the financial risk in the proposed US–USSR gas deal and in the Siberian fields of Urengoi and Medvezhye was political.

In cooperative ventures, such as those underway in the Soviet Union, the economic interdependence raises questions of political leverage. Does the material-rich communist nation with the production facility in its sovereign territory have more control or leverage than the technologically advanced Western nation that is dependent on part of the output for the repayment of its investment? *The presumption of greater leverage for the socialist nation may be further strengthened by the fact that most Western investment is committed before returns in Eastern materials are forthcoming.* The proposed "North Star" and Yakutia natural gas projects are cases in point. The investment by the United States and/or Japan would be committed in the first decade, whereas the repayment would occur in a subsequent decade or later. There would thus be a strong temptation for the Soviet Union to risk its reputation for creditworthiness by failing to comply with the repayment agreement once the Western commitment were made. For example, if an agreement were reached in 1974, deliveries would be set to begin in the early 1980s. At that time, the Soviets might raise the price and reduce deliveries. To be sure, they do not have a reputation for so flagrantly violating contractual agreements. They would probably thereby lose their good financial reputation and whatever subsequent deals were under consideration. But the temptation for noncompliance would be present, as not many subsequent agreements would be likely to have the scale in time and resources of the energy deals.

Specifically, in the energy deals the point would be reached when all of the Western investment committed and the Soviet repayment to begin. The inducement to comply would be related to attractiveness of future Western investments that noncompliance would deny them. Most of the other discussions involve millions, not billions of dollars and cover ten years or less. The multibillion dollar energy agreements would span two or three decades. The prospects of future agreements must be an important leverage factor on contract compliance. If the leverage of future Western agreements and creditworthiness are to be effective, then industrial cooperation involving technology transfer should be made in a succession of arrangements, each of similar magnitude. Thus, *the adherence to terms of any one agreement are reinforced by the potential denial of industrial cooperation on subsequent agreements.*[25]

With financing and equipment supply for Yamburg preceding repayment from gas delivery the temptation to the Soviet Union would be to accept Western imports and credits and to reconsider supply and price agreements at a subsequent point. Repayment conditions could have some penalties or benefits foregone rather than just a reliance on a past record of repayment. The benefits foregone to the USSR would be in future technology and credit. Specifically, the Soviet economy would have to support the long list of projects requiring Western technology with its own resources. The assessment of this sort of political risk posited for the critique of the proposed "North Star" project in 1973–74 for the US and USSR still seems relevant in the West European financing of a major Soviet pipeline in 1981.

In reference to the discussion of the "North Star" in 1973–74 we also asked the following questions:

Is the Soviet project a preferred investment, eligible for lower rates, more favorable terms, and higher risks than other investments? If preferential treatment for the natural gas project is warranted by political factors, what are the net political benefits?[26]

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[25] *Ibid* [Western Investment] pp. 13–14.
[26] U.S.-U.S.S.R. Commercial Relations *op. cit* p. 72.

The answer of the United States Congress in 1974 to this kind of a question was a resounding "No!". Section 402 (the Jackson-Vanik amendment) of the Trade Act closed the government credit window, the Church and Stevenson amendments to the Export-Import Bank Act precluded government credit for use in large scale Soviet natural gas development by restricting funds available to very small amounts.[27]

The financing of Yamburg is a European decision, however, not directly influenced by American governmental policy. Europeans apparently view the risks, costs, and benefits of Yamburg in 1981 differently from the U.S. policymakers' assessment of North Star, in 1974. Should a reassessment by U.S. policymakers on government backed credits and guarantees for Soviet energy projects take place? If so the following questions might be in order:

(1) Should the U.S. try to dissuade the West Europeans from finalizing the Yamburg deal at this time of heightened international tensions?

(2) Should the U.S. try to persuade the West Europeans not to provide lower than market rate interest rates on loans associated with the Yamburg project?

(3) What should overall policy be for U.S. banks and businesses that want to become involved in the Yamburg deal?

(4) What precautions can the U.S. realistically press the Europeans to take in case of Soviet cut off of gas? What specific safeguards have West Europeans built into the system?

[27] See Joint Economic Committee. *Issues in East-West Commercial Policy*, Washington, D.C. GPO, 1979.

V. ENERGY CONSERVATION IN THE USSR

By Leslie Dienes*

1. Introduction

The conservation of natural resources, including that of energy, is a notion subject to widely different interpretations. An implicit or explicit understanding of the concept which tends to dominate among environmentalists regards conservation as preservation of nature's bounty or at least (and particularly with found resources) a sharp reduction in the rate of use. This is deemed desirable both for its own sake and for the sake of future generations. For economists, on the other hand, conservation becomes basically an expression of economic efficiency. Given their preferences for synthetic aggregates, their confidence in endless, reasonably smooth substitution and an identifiable common value for the gamut of input and output streams, economists tend to see conservation as an aspect of the optimum allocation of all resources.

Given the rising cost and scarcity of energy today, such an allocation should lead to more economic utilization, i.e. conservation *per unit value of GNP*, of that resource. Within this framework, this writer sees basically two such ways to such economy: (1) The substitution of other inputs (capital, labor, other materials) for energy; and (2) the substitution of the different energy forms for each other and their consequent allocation among consumers (technological equipment, sectors, export) in their regional dimensions so as to equalize the relevant marginal ratios. In the short run all such substitution and allocation must take place essentially within the confines of existing technology and the sectoral and geographic structures of the economy. In the longer run, however, the creation of new production functions, which save inputs generally or increases the flexibility of substitution, or which promotes structural and locational adjustments to higher energy costs becomes the chief engine of the conservation process.

In the USSR, as elsewhere, the currently much emphasized conservation of energy is a melange of arbitrary attempts at physical preservation and of partial application of economic principles. It is my opinion, however, that the Soviet system is and will be less able than Western nations to check the increase of energy demand by decoupling it from economic growth. Because of the nature of Soviet economic management, combined with structural and geographic peculiarities of the energy system, administrative attempts at the physical kind of conservation (i.e. stretching supplies by curbing allocation) should be most successful in sectors which are small consumers of state furnished energy sources, particularly of high quality types and forms. Saving energy by such means in high priority sectors, such as leading indus-

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tries and agriculture, is far less likely to be successful given the nature of the planning process, the influence of these branches and the vested interest of the leadership. Administrative measures are simply poor tools in improving technical coefficients over broad fronts of an economy, especially in a very large one with extreme variations in the type and age of equipment and technologies even in the same branch.

In contrast to the arbitrary stance of environmentalist, this writer finds the economic view conceptually attractive. However, he regards it as so dauntless and all inclusive as to be perilous in practice. One has reason to doubt whether aggregate production functions can represent the sequence and limits of engineering processes and the technical possibilities available to an economy. In addition, the treatment of natural resources in economic models as basically no different from other factors of production has come into question. Certainly, there is equal evidence now to conflict with the view that progressively greater quantities of lower grade materials are always available, even if the assumption (implicit in all neo-classical models) of limitless substitution of labor or capital for exhaustible resources would be accepted as realistic. The acidly cogent exposition of Georgescu-Roegen regarding the concept of entropy in the economic process and the dogmatic rejection of it by economists ought to be taken seriously.[1]

On the other hand, prices and other economic signals also cannot be relied on to change rapidly and noticeably the relationship between the growth of energy demand and that of GNP as long as physical production targets and input allocation remain the core of Soviet economic planning. By giving signals they may even work at cross purposes with efforts to improve efficiency by streamlining technical coefficients. Finally, substitution of other inputs for energy and substitution among the various energy forms in the different functional sectoral uses are hindered by serious structural and geographic rigidities and barriers even in the long run, not to mention shorter time periods. Specifically, this will force the continued, large scale burning of hydrocarbons, especially oil, in economically sub-optimal uses. It will also prevent nuclear plants from taking over much more than half of the base-load and more than a fraction of total power generation in this century even in the European USSR.

2. Energy Consumption and Economic Growth in the USSR: Structural Relationship and Prospect

The relationship of energy consumption and economic growth over time in countries with different economic structures, physical endowments and social customs is a complex and controversial matter, still largely unresearched. While there is evidence that, in the long term, this relationship is malleable, the degree of potential flexibility is disputed even with respect to our country, which we know best. The relative influence that actual and potential structural changes (both of a sectoral nature and with respect to the thermodynamic character of energy use) versus managerial and consumer responses have on energy-GNP ratios are very difficult to unscramble.

[1] For an excellent evaluation of these issues see V. Derry Smith and John V. Krutilla, "Resource and Environmental Constraints to Growth," *American Journal of Agricultural Economics*, August 1979, pp. 395–408. For the best concise summary of Georgescu-Roegen's views see, "Energy and Economic Myths," *Southern Economic Journal*, January 1975, pp. 347–81.

In a 1977 report, I attempted a very rough assessment of the post-war trend in the energy intensity of the Soviet economy.[2] I argued that, even though the aggregate energy requirement per unit GNP declined sharply during the 1950's and 1960's, but not afterwards, there was little evidence of any systemic shift towards a less energy demanding economic structure. There was no decline in *net* energy use, i.e. energy turned into useful work or incorporated in products. The drop in aggregate energy consumption per unit of national income could be explained by the rapid shift to hydrocarbons and the especially swift substitution of these efficient fuels in certain sectors or functions (railway haulage, chemical industry) with particularly large economic effect, a point also emphasized by Campbell.[3] Electrification was an equally significant factor. As in other countries, it greatly enhanced the flexibility and efficiency of factory and, later, agricultural operations. Meanwhile, the share of conversion losses, implicit in increased electrification were kept within bounds by improvements in the heat rate and the growth of cogeneration. A striking confirmation of my 1977 claim concerning the USSR's failure to reduce *net* energy requirement per unit of GNP comes from recent Soviet research.[4] These studies conclude that in the past 20–25 years the energy intensity of Soviet national income, *when computed on the basis of utilized energy*, decreased by less than 5 percent. Given the fact that according to all Western experts, the official index for GNP growth is greatly inflated, *net* energy use per ruble's worth of national income clearly must have remained constant or even increased. Moreover, the 5 percent reduction averred was accomplished not by saving of direct energy input, but primarily indirectly, by reducing material inputs in industry. Sectoral changes also had virtually no net influence. Within industry, the impact resulting from some shift towards the lighter, less energy intensive engineering branches was compensated by the opposite effect of the rapid development of the chemical industry and of the declining quality and accessibility of mineral resources. Minor reduction in the *net* energy intensity of the domestic-municipal economy was counteracted by the adverse trend in agriculture and, to some extent, transportation. (Gross, but not net or utilized energy in the latter sector declined sharply per value of work produced.)

If past experience suggests no decrease in *net* energy use per ruble of national income, the *aggregate* energy requirement (i.e., the demand for raw fuels, hydro and nuclear electicity) per unit of GNP can continue to decline only if one or both of the following take(s) place: (1) Utilization efficiency; namely, the ratio of gross to net consumption in specific applications, goes on improving at a significant pace; and (2) structural shifts in the economy towards less energy and material intensive sectors and branches with high value added occur. The first may result from the substitution of more efficient fuels, processes, utilization technologies and from stretching supplies by better organization and allocation.

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[2] L. Dienes, "Soviet Energy Policy and the Hydrocarbons," in Association of American Geographers, Discussion Paper No. 2. *Project on Soviet Natural Resources in the World Economy* (Syracuse University, 1978), pp. 4–14.

[3] Robert Campbell, *Soviet Energy Balances*. Rand Corporation. Research Report R–2257–DOE, December 1978, pp. 14–25.

[4] *Teploenergetika*, No. 2. 1979, pp. 2–3 and A. A. Makarov and A. G. Vigdorchik, *Toplivno-energeticheskii kompleks* (Moscow: "Nauka," 1979), pp. 86–90.

The substitution of hydrocarbons for solid fuels has basically come to an end. Indeed, at least over the long run, some degree of reverse substitution is envisaged, even though it encounters tremendous difficulties. The quality and/or accessibility of mineral resources continues to decline at an accelerated rate, while many technological improvements, particularly in power generation, are approaching thermodynamic limits in the best plants. I have thus argued that, *at the margin at least*, technological progress in increasing energy efficiency will slow down considerable in the future. Average system efficiency may continue to improve, of course, albeit at a slower rate, as obsolete equipment is replaced or modernized. But given the very slow retirement rate characteristic of the Soviet capital stock and the rapidly worsening accessibility of natural resources which demands rising energy input, further technical advances to improve energy efficiency will be slower than in the past.

The evidence of the 1970's clearly shows that, at least so far, Soviet planners have failed to decouple economic growth from increasing energy consumption. The decline in the aggregate energy requirement per unit of GNP, experienced during the period of shifting to efficient or cheaper hydrocarbon fuels (say, 1955 to 1970) was no longer observable during the past decade. In the first eight years of the seventies, utilized national income (excluding services) increased only marginally faster (by 46 versus 43 percent) than gross energy demand even by Soviet calculations.[5] With the slower growing services added, it could not have grown faster than energy consumption at all. Indeed, both by US State Department and CIA computations, the rise in Soviet GNP between 1970 and 1978 fell below the increase in domestic energy requirements as given in the Soviet yearbook.[6] Average yearly rates in the two aggregates, of course, fluctuated appreciably, as in any country, and in far from parallel fashion. Yet it is obvious that, on the average, the relationship between the rise of gross energy demand and that of national income during the seventies was, at best, one to one, and probably worse.

Soviet experts appear as uncertain concerning the development of that relationship in the future as their Western counterparts. Some scholars foresee a mere 1 to 2 percent improvement in conversion and utilization efficiency, i.e., net/gross energy consumption, in the forthcoming decade, which bodes ill for the likelihood of reducing the energy intensity of Soviet GNP itself. Others are more hopeful, but on closer examination their expectations show contradictions which make such an attainment highly improbable. The two experts whose studies revealed virtually no decline through the past quarter century in the quantity of utilized energy per ruble of national income speak of the possibility of a fairly rapid decrease in the energy intensity of industry per value added (and still more per gross value of output) in the next 15 or so years. Yet, they foresee this possibility in conjunction within an increased relative level of electrification, needed both to effect technological advance and to substitute electricity for scarce hydro-

[5] *Narodnoe Khoziaistvo SSSR v 1978 godu* (Moscow: "Statistka," 1979), pp. 34 and 44.
[6] Ibid, p. 44; US, CIA, National Foreign Assessment Center, *Handbook of Economic Statistics*. ER 79–100274. August 1979, p. 22; Herbert Block, "Soviet Economic Performance in a Global Context," in US Congress, Joint Economic Committee. *Soviet Economy in a Time of Change*, Vol. I (Washington: US Government Printing Office, 1979), pp. 135–140 and Imogene Edward *et. al.*, "US and USSR: Comparisons of GNP," *Ibid*, p. 391.

carbons.[7] These two trends will be hard, if not impossible, to reconcile before the end of the century. Given the low quality of coal in power generation and the increased role of solid fuels for that purpose and boiler use as a whole in Soviet plans, increased electrification should lead to some acceleration in gross energy input. As mentioned, thermodynamic limits in the best thermal plants are being approached and reliance on coal and lignite for most incremental growth will make further improvement practically impossible.[8] Increasing system efficiency rapidly would require much faster replacement of old inefficient plants than experienced in the past and a faster growth of capacity than of power generation itself. With the strain on the power machinery and construction industries and investment resources in general, this is most unlikely.[9]

3. Allocation and Substitution

The economist's notion of conservation also requires an optimal allocation of scarce resources so as to maximize their disparate economic effects in the various uses (i.e., so the marginal rate of substitution between corresponding applications would be equal). In the case of hydrocarbons today, this means assigning them, as much as possible, for mobile, petrochemical and furnace demand and for export, again with some obvious differentiation between oil and gas in these functional markets. Burning hydrocarbons under boilers, where the economic cost of utilizing inferior fuels is the least onerous and where this is technologically the most feasible, is now viewed as a suboptimal allocation virtually everywhere. This is particularly true for electric power generation where, in addition to solid fuels, nuclear reaction is a feasible alternative to burning oil and gas. And over the long haul, nuclear sources via electricity could provide a practical substitute for hydrocarbons in most furnace uses. The thermodynamic character of high temperature processes, combined with their continuous nature and increasing requirement for purity, can make a greater application of electric power (a high refined and expensive form of energy) attractive and economically justified. An increased application of oxygen in smelting may also be regarded as an indirect use of electricity, since electric power represents by far the largest input in oxygen production.

Since I have written at length on the problem of fuel substitution in the USSR elsewhere, only a few words need to be said here. I will add some new reflections about the role of nuclear power in the process, and the limited potential it has for saving oil and gas. In 1976, about 270 million tons of oil equivalent of oil and gas (about 385 million standard tons) were burned under boilers of all sorts, with almost two-thirds of this in power plants alone. The production of electricity,

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[7] A. A. Beschinskii and Iu. M. Kogan, *Ekonomicheskie problemy elektrifikatsii* (Moscow: "Energiia," 1976), pp. 23–24 and 200–202 and *Teploenergiia,* No. 2, 1979, p. 3 and Makarov and Vigdorchik, *op. cit.,* pp. 127–29.

[8] Even the more optimistic Makarov and Vigdorchik expect the ratio of net to gross energy consumption to increase from the present 43–44% to only 46–47% in the future, apparently the early or mid-1990's. Makarov and Vigdorchik, *op. cit.,* p. 129.

[9] In 1975, 26% of all Soviet thermal station capacity had been on line for more than 16 years, with 6.4% for more than 30 years. This, of course, represents a very much higher percentage of total plants and the small average size of these old stations, combined with low steam pressure, results in low efficiency. In Soviet industry as a whole the average annual figure for assets written off fell from 2.2% in 1966–1970 to 1.6% in 1971–1975. *Teploenergetika,* No. 4, p. 18 and *Planovoe khoziaistvo,* No. 3, 1979, pp. 77–78.

steam and hot water claimed more than a third of all petroleum and some 55 percent of all natural gas used by the Soviet economy, including self-consumption, losses and storage.[10] That Soviet planners are unhappy about this use pattern is shown in wide range of recent writings. However, as I have argued for some time, the USSR simply cannot expand the production of solid fuels, particularly west of the Urals, at more than a fraction of the growth rate of aggregate energy demand in the foreseeable future. Consequently, they cannot reduce the quantity of oil and gas burned under boilers and even holding to current levels usage seems very unlikely.[11] Significant replacement of oil by gas in the production of electricity and steam, as well as furnace type application, however, is almost certain and is already taking place to some degree. Further such substitution is called for in the 1980 Plan and is advocated by such influential experts as Academician Styrikovich.[12]

Yet even this switch, which represents the most feasible and environmentally benign case of fuel substitution, encounters serious constraints. In the concrete world of fluctuating heating schedules, of costly *in situ* equipment and, for gas, highly capital intensive storage and distribution facilities, the lumpiness of fixed capital and developmental lead times preclude the smooth and easy replacement of liquid products. For example, a recent study reveals that to accommodate the planned decline in the share of fuel and other heating oils, underground storage capacity for gas would have to be expanded by 10–15 times over a similar number of years.[13] Naturally, the gas distribution network would also have to grow very substantially. Once on gas, industrial enterprises resist being put on an interruptible schedule, requiring seasonal switches to other fuels. The price incentives for such switching seem inadequate, supplies or quality of alternative fuels unreliable, and the perception of equipment tolerance and cost of the maneuver at the enterprise level clearly differs from that further up in the industrial hierarchy. All these exacerbate fuel substitution even between the two hydrocarbons, resulting in the unnecessary overexpenditure of natural gas in many branches and a concurrent shortage in other sectors.[14]

Nor can the prospect of gas-for-oil substitution be divorced from the growth of aggregate energy production with respect to demand. Given the falling level of coal production in the European USSR and, at best, a marginal increase in the future, given the technical and economic problems of shipping (directly or via electricity by high-tension wires) truly large quantities of solid fuels from beyond the Urals, even coal and gas combined cannot be expected to cover all boiler requirements before the end of the 1980's. Except for coke, furnaces

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[10] L. Dienes and T. Shabad, *The Soviet Energy System: Resource Use and Policies* (Winston and Sons, 1979. Distributor John Wiley, New York), Chapter 8, especially, pp. 221–31.

[11] Ibid., pp. 107–112 and 249–51 and Leslie Dienes, "The Regional Dimensions of Soviet Energy Policy," in Association of American Geographers, Discussion Paper No. 2. Project on *Soviet Natural Resources in the World Economy* (Syracuse University, August 1979), especially pp. 34–46. An early prediction of the impending fuel constraint is found in L. Dienes, "Energy Self Sufficiency in the Soviet Union," *Current History,* July/August 1975, pp. 10–14 and 47–51.

[12] See Brezhnev's speech in *Ekonomicheskaia gazeta,* No. 49 (December 1979), p. 4 and M. A. Styrikovich, "Energeticheskoe polozhenie v mire," *Ekonomika i organizatsiia promyshlennogo proizvodstva,* No. 11, 1979, p. 87.

[13] *Teploenergetika,* No. 2, 1979, p. 5.

[14] *Izvestiia,* October 28, 1979, p. 2.

will continue to depend on hydrocarbons to an overwhelming extent, with return to solid fuels infeasible,[15] but a greater role for electricity (directly and via oxygen) a suitable technological alternative. Therefore (considering also export needs to East Europe and elsewhere), Soviet hydrocarbon resources as a whole will be very strained throughout the eighties, and especially so if oil production declines. Relief cannot come for solid fuels, a prospect which underlies the crash program to increase the role of nuclear power. Yet, while the latter can mitigate somewhat the serious energy shortage in the European USSR, particularly the cis-Volga provinces, its role in saving oil and gas in this century will be small. In the forthcoming 15–20 years, it can do nothing to replace the close to 300 million tons oil equivalent of hydrocarbons burned under boilers today. Atomic power cannot even prevent some *growth* in demand for oil and gas in the generation of electricity and steam during the 1980's. Structural rigidities in the Soviet power system will prevent such substitution for many years to come.

The crucial fact is that nuclear stations are appropriate only for the base load, which in the USSR must be shared by co-generating plants. The USSR today is the world leader in cogeneration. In 1976, dual purpose turbines represented 37 percent of all thermal generating capacity in the country, with 55 percent of their fuel demand, but perhaps two-thirds in the European provinces, consisting of hydrocarbons.[16] Thus keeping to a minimum plant factor of at least 5500 hours per year (a 63 percent availability) would allow no more than 22–24 percent of total capacity to be represented by atomic stations, according to Soviet specialists.[17] West of the Urals, this share will be reached when current nuclear capacity triples to near 50 million KW. With the start of Atommash, the serial production of reactors and the high priority assigned to the industry, such capacity surely should be on line by the mid 1990's, perhaps even before.[18]

A further growth in that share presents very serious difficulties. It would require the development of much more flexible cogenerating stations and the reconstruction of many existing turbines to curtail their heat regime, even though this would worsen their economic effectiveness. Alternately or concurrently with the above, it would require the swift development of nuclear reactors for space heating and process steam, both with and without electricity production. Intensive research along this line is underway today. Yet even with rapid progress and satisfactory solution to all safety problems, such reactors can, at best make only a token contribution to energy supplies in this century.

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[15] Dienes and Shabad, *op. cit.*, Chapters 4 and 8 and pp. 249–57.

[16] P. S. Neoporozhnii *et al.* ed., *Razvitie elektrifikatsii SSR. 1967–1977* (Moscow: "Energiia," 1977), p. 46 and *Teploenergetika*, No. 2, 1979, p. 4.

[17] *Elektricheskie stantsii*, No. 3, 1978, pp. 7–9.

[18] At the end of 1978, civilian nuclear generating capacity in the USSR reached 8.1 million KW. *Elektricheskie stantsii*, No. 1, 1979, p. 2 and *Teploenergetika*, No. 1, 1979, p. 4. It was planned to put 6.3 million KW on line from January 1978 to the end of 1980, to reach a total of 14.4 MW. The 18.5 million KW original plan for 1980, already a scaled down target, is clearly unattainable. Gloria Duffy, *Soviet Nuclear Energy: Domestic and International Policies* (Santa Monica, Cal.: Rand Corporation. Research Report R–2362–DOE, December 1979), p. 44 and *Elektricheskie stantsii*, No. 8, 1979, Table 5, p. 6. All nuclear stations, save two small plants are located in the European USSR, where future expansion, too, will take place.

In 1975, the joint capacity of all interconnected thermal power stations in the Unified European Grid totaled 103 million KW. Given the emphasis on nuclear power and the shortage of fossil fuels west of the Urals, conventional thermal capacity in this region should grow relatively slowly. With a 2.5–3% annual rate, it would reach 150–160 million KW by 1990. *Teploenergetika*, No. 4, 1979, p. 18.

The 54.8 billion KWH of nuclear power generated in 1979 saved only 18 million tons of standard fuel,[19] less than the heat content of state supplied firewood or that of peat and shale combined.[20] The 50 million KW capacity that may be on line by the early or mid 1990's could save 80–100 million tons of standard fuel (SF), depending on the load factor. This would be a major contribution, approximating the output of all solid fuels in the European USSR aside from Donbas coal.[21] Yet this capacity would cover only the *increment* in power generation west of the Urals during the forthcoming decade, even assuming a mere 3 percent yearly growth in electricity demand.[22] It cannot reduce the nearly 200 million tons of oil equivalent (circa 280 million tons of SF) of hydrocarbons burned in electric stations today, not to mention the additional 80 million tons of oil equivalent consumed to raise steam for other than power generation.[23]

Allocation Priorities and Private-Communal Consumption

Conforming to historical experience in other countries, the Soviet industrialization drive shifted the main focus of energy demand from the household-municipal to the industrial sector. Between the late 1920's and the mid 1960's, the share of households in total energy delivered declined from over one-half to below one-fifth, while that of industry rose from less than 30 percent to over 50.[24] A similar sectoral change took place in the US between 1880 and 1920, though manufacturing and mining here never achieved the degree of preponderance in total energy use as it did in the Soviet Union. Moreover, the dominance of US industry declined dramatically since 1920, with a corresponding growth in household-municipal consumption and, still more, private transportation.[25] By contrast, in the USSR the relative share of industry continued to rise right up to the present, albeit at a slower rate, and since the mid-1960's agriculture, too, has been the recipient of an increasingly generous portion of the country's energy resources. The share of the household-municipal sector stabilized well under one-fifth of aggregate energy consumption, while that of private transportation remains entirely negligible.[26]

As Campbell observed, such a distinctive pattern of sectoral allocation means that the residential-municipal sector and private transportation, which are so important for the US in conserving energy, cannot play a similar role in Soviet efforts.[27] There is evidence that the household sector may be further squeezed and, in particular, the already minimal use of petroleum (9 million in 1975, see table 1)

[19] Computed according to data given for average fuel consumption per KWH at Soviet utility stations *Narvodnoe khoziaistvo SSSR v. 1978 g.*, p. 143 and *Stroitel'naia gazeta*, April 20, 1980.

[20] *Narodnoe khoziaistvo SSR v 1978 godu*, p. 144.

[21] Dienes and Shabad, *op. cit.*, pp. 110–11.

[22] In 1978, the Unified European Grid generated 865.29 billion KWH of electricity, with only very small portion of it beyond the Urals. *Ekonomicheskaia gazeta*, No. 7 (January 1979), p. 2. A 3% average annual rate would increase this to 1.233.73 billion KWH, an increment of 368.4 billion KWH, less than one tenth of which could be generated by hydro stations. With expected heat rates, the rest would require an increment of 105–110 million tons of standard fuel, if that increase were to come from conventional thermal plants.

[23] Dienes and Shabad, *op. cit.*, pp. 224–25.

[24] S. D. Fel'd, *Edinyi energeticheskii balans narodnogo khoziaisva* (Moscow: "Ekonomika," 1964), pp. 292 and 300.

[25] Sidney Sonenblum. *The Energy Connections: Between Energy and the Economy* (Cambridge, Mass.: Ballinger Co., 1978), pp. 82–83 and 234–35.

[26] Robert Campbell, *Soviet Energy Balances* (Santa Monica, Cal.: Rand Corporation. Research Report R–2257–DOE, December 1978), Tables 1–5, pp. 4–8.

[27] Ibid., pp. VI–VII.

reduced still more. Recently, rural consumers in Tadzhikstan were found guilty and responsible for burning a mere 6500 tons of liquid products for space and water heating instead of coal.[28] Given their negligible role, however (table 1), efforts to save refinery fuels in that sector can have little practical significance.

ABLE 1.—STRUCTURE OF FUEL CONSUMPTION BY STOVES AND APARTMENT-BLOCK BOILERS IN THE HOUSEHOLD-MUNICIPAL SECTOR (1965–75) SOVIET ESTIMATE

Type of fuels	1965		1970		1975	
	Million tons of SF	Percent	Million tons of SF	Percent	Million tons of SF	Percent
Coal and briquets	68.3	44.0	82.9	45.3	90.0	45.0
Peat and briquets	3.4	2.2	4.0	2.2	8.9	4.5
Wood (State supplied)	12.0	7.8	11.9	6.5	12.0	6.0
Pipeline gas	17.8	10.8	29.9	16.3	42.6	21.3
LPG	1.1	.7	3.1	1.7	5.2	2.6
Liquid fuels	4.9	3.2	2.6	1.4	13.0	6.5
Coke	1.0	.7				
Other types of fuel	.9	.6	4.6	2.5	3.3	1.6
Self-produced fuel by population	46.6	30.0	44.0	24.1	25.0	12.5
Total	156.0	100.0	183.0	100.0	200.0	100.0

Source: Ryps (1978), p. 20.

On the contrary, the household-municipal economy represents a large potential claimant on high quality energy resources, especially hydrocarbons. As of now, consumers here have modernized their energy use to a much smaller degree than those in other sectors, especially in the countryside. Through the decade from 1965 to 1975, the portion of individually fired stoves in total fuel consumption by the household-municipal economy remained very high, declining negligibly from 73.7% to 72.5%, though these stoves contributed a notably smaller share in useful heat delivered (56% at the later date).[29] In addition, coal, lignite, peat and wood comprised more than two-thirds of all fuel supplied to these stoves plus small apartment block boilers (by heat content) even in 1975. Their absolute amount actually increased during the previous 10 years and continued to exceed 130 million tons of coal equivalent, of which some 25 million was still gathered by the population itself and an almost equal amount represented by state supplied peat, wood and other minor fuels (table 1). In such an important province as Kharkov Oblast, next to the Donbas and with three of the largest Ukranian gas fields, wood stoves still furnish heat for 526,000 houses, though given the steppe location, wood hardly seems to be an abundant commodity.[30] (This means for half the population, including the city of Kharkov, even assuming less than 3 persons per household).[31] Firewood continues to be a crucial household fuel in Belorussia, the Baltic region, Siberia and elsewhere.[32]

[28] *Kommunist Tadzhikistana*, June 26, 1979, p. 1.
[29] G. S. Ryps, *Ekonomicheskie problemy raspredelentia gaza* (Leningrad: "Nedra," 1978), pp. 18–19.
[30] *Pravda*, October 18, p. 3.
[31] According to the census of January 17, 1979, the population of Khar'kov Oblast', including the city of Khar'kov was 3,056 thousand. *Ekonomicheskaia gazeta*, No. 18 (April 1979), p. 15.
[32] Sovetskaia Belorussiia, August 9, 1979, p. 2; *Sovetskaia Latviia*, July 25, 1979, p. 2 and *Teploenergetika*, No. 2, 1979, Table 2, p. 12.

The vast burden such traditional methods of heat supply has placed on the population, estimated to exceed 400 million labor days in 1976, was largely ignored until recently.[33] Though the amount of self produced fuel dropped by one-half between 1965 and 1975, that absolute decline was compensated entirely by state furnished coal (table 1), with the usual snags in distribution and home delivery (the latter frequently via the second economy), resulting in wasted consumer time. And because the absolute amount of all solid fuels burned in individually fired stoves and mini-boilers actually rose during the period, little reduction in total labor expenditure was effected. It could be argued as Campbell did in 1968, that in the past with a relative manpower surplus, the economic returns represented by a shift to gas and oil in the household sector could not have been easily captured by the leadership and "devoted to the objectives it was interested in maximizing."[34] In the labor-short eighties, however, the situation should be different. That wasted labor time is bound to impinge significantly on planners' resources, at least in the Slavic and Baltic republics. As with other "non-productive" activities and infrastructure, parsimony in resource allocation and failure to modernize will affect the performance of the entire economy.

Such opinions have begun to surface lately in the technical literature. It is admitted, for example, that the bulk of the rural population, which today relies almost exclusively on decentralized, individual heat supply, must continue to do so in the future. Settlements under 1,000 souls, which comprised 96 percent of all the villages and accounted for 62 percent of the 1970 rural population of the RSFSR (in the non-black-earth zone four-fifths) cannot be economically provided with heat and hot water from boilers. For all these settlements, economic comparisons of fuel use favor refinery products (in case of proximity to main pipelines also of gas) over coal. In time of great anxiety over rural outmigration, their 90 percent dependence on largely unsorted coal, peat and wood is now viewed with concern.[35] The modernization of energy supply to the rural population is claimed to be the subject of intensive, purposeful research in recent years.

A rising demand for hydrocarbons, both for the domestic-municipal economy and for industry, issues also from the powerful Siberian lobby. Siberian scientists decry the coal-biased distortion (*ugol'nyi perekos*) in the fuel mix of the Trans-Ural RSFSR, which aggravates living conditions and results in excessive labor expenditure in an already difficult environment, plagued by manpower shortages and high turnover. In 1978, natural gas, liquid products, semi-coke, even briquets were almost entirely lacking for small consumers, that had to depend instead on high-ash lignite and coal for their heat supply. The servicing of small boilers alone is said to employ over 100,000 persons in Siberia, not counting those engaged in the transport of coal and ash.[36] There are hundreds of them, not only in small towns

[33] *Ekonomicheskaia gazeta*, No. 48 (November 1977), p. 13.
[34] Robert Campbell, *The Economics of Soviet Oil and Gas* (Baltimore: John Hopkins press, 1968), p. 216.
[35] Makarov and Vigdorchik, *op. cit.*, pp. 113–15 and D. I. Valentei, ed., *Nechernozem'e: Demograficheskie prosessy* (Moscow: "Statistika," 1977), especially, p. 42.
[36] Akademiia nauk SSSR, Sibirskoe otdelenie, Inst. ekon., *Razvitie narodnogo khoziaistva Sibiri* (Novosibirsk: "Nauka," 1978), pp. 173–79.

but even in big cities, such as Krasnoiarsk and Irkutsk, contributing to severe air pollution in a region where in wintertime nearly permanent temperature inversion is the rule. In addition, thousands of stoves and fireplaces, the majority most likely burning wood, still provide 55–60 percent of residential heat in Siberian cities and probably all in rural areas.[37]

4. Utilization of Secondary (Byproduct) Energy Resources

In modern economies, improvements in the technological efficiency and speed of most operations have been purchased at the price of rising energy input and increased entropy. For any process that involves the flow of heat, for example, rates of production go up as temperature gradients become steeper. While this augments entropy in the process itself, the utilization of progressively degraded energy for *different* operations is in no way precluded by the Second Law. The Russians correctly identify this potential pool of "secondary energy resources" (SER) as a major target in the conservation effort. They define such resources as by- and waste-products energy which no longer renders work in the technological aggregate it originates, but is fully or partially utilizable as an energy source in another aggregate and process.[38] In recent decades, the growing importance of thermodynamically less efficient high temperature processes has increased opportunities for such re-use, at least in stationary operations, which greatly dominate Soviet energy consumption.

Aside from waste heat recapture by cogeneration, where the country is the world leader, the utilization of secondary energy in the Soviet Union is relatively modest. Without cogeneration, byproduct energy use in 1975 amounted to 45 million tons of standard fuel, with additional planned by 1980, almost all of it in industry.[39] This represents only a little over 3 percent of all energy input into the economy,[40] but waste heat recaptured at power stations, which Soviet data do not include among SER, more than triples this amount to roughly one-tenth of aggregate energy consumption (cogenerating stations produced 918 million gigacalories of heat, equivalent to 131 million standard tons in 1975, while the 1980 plan, which has proved unattainable, called for 1130 million gigacalories or 161 million tons).[41]

What are the prospects for conservation by increasing byproduct energy use? Soviet authorities are unanimous on conserving via the economic effectiveness of such re-capture, particularly west of the Urals. The required costs are claimed to be 3–4 times less than production, transport and capital costs for an incremental ton of fossil fuels of equal calorific content for the USSR and 4–6 times less in the European provinces. Capital requirements per standard ton of SER, for example, are said to approximate 18 rubles in oil refining

[37] *Teploenergetka*, No. 2, 1979, pp. 12–13 and *Pravda*, May 22, 1978, p. 3.
[38] S. P. Sushon et al., *Vtorichnye energeticheskie resursy promyshlennosti SSSR* (Moscow: "Energiia," 1978), p. 6.
[39] S. Iatrov and A. Piatkin, "Effektivnost" ispol'zovaniia toplivno-energeticheskikh resursov," *Planovoe khoziaistvo*, No. 2, 1979, p. 14. Forty-three million tons of this was utilized by industry. Sushon *et al.*, *op. cit.*, p. 110.
[40] *Narodnoe khoziaistvo SSSR v 1978 godu*, p. 44.
[41] Neporozhnii et al., op. cit., p. 117 and A. M. Nekrasov and V. Kh. Khokhlov," Elektroenergetika v desiatoi piatiletke," *Izvestiia VUZ*. Energetika, No. 9, 1976, p. 5. The second source gives a slightly higher figure for 1975.

and 11 rubles in the iron and steel industry.[42] With such economies, further recycling of byproduct energy is clearly attractive. As will be shown, a greater relative dependence on cogeneration is proving very difficult, at least until nuclear stations can be used in such fashion. Soviet specialists, however, expect increased consumption of SER in industry, anticipating an eventual doubling of the quantity used. While byproduct gases for combustion today are almost 90 percent utilized (with their amount thus growing slower than aggregate energy demand), significant potential still lies in the recapture of low and medium temperature heat via steam, particularly in metallurgy, petroleum refining, petrochemicals and building material production (table 2). Geography and the dispersed nature of operation seriously constrain the recapture of the fast growing quantities of waste heat in the gas industry, particularly compressor stations.[43]

TABLE 2.—FUEL ECONOMIES FROM UTILIZATION OF SECONDARY (BYPRODUCT) ENERGY RESOURCES IN SOVIET INDUSTRY FOR 1975

[In million tons of standard fuel equivalent]

Industrial branches	Fuel economies	
	Possible	Actual
Steam and hot water (through heat exchangers):		
Ferrous metallurgy	19.2	5.9
Nonferrous metallurgy	2.0	.6
Petroleum refining and petrochemicals	5.2	2.8
Chemical industry	4.5	3.4
Gas industry	2.3	.2
Heavy machine building	.6	.2
Building materials industry	1.0	.03
Total	34.8	13.1
Combustible gases and materials:		
Ferrous metallurgy	26.5	24.6
Petroleum refining and petrochemicals	3.9	2.7
Chemical industry	1.4	.8
Pulp and paper industry	1.9	1.8
Total	33.7	29.9
Grand total	68.5	43.0

Source: S. P. Sushon et al., "Vtorichnye energeticheskie resursy promyshlennosti SSSR" (Moscow: "Energiia," 1978), p. 110

Yet, one must put all these savings into perspective. At the 1975 level, the difference between the actual and the feasibly recoverable amount of secondary energy resources amounted to 25–26 million standard tons (table 2), no more than the equivalent of *state furnished* firewood and less than the supply of shale and fuel peat combined. It reached less than 2 percent of aggregate energy consumption that year.[44] The 120–130 million standard tons of SER that is considered recoverable perhaps 15 years hence would amount to 5 percent of gross energy demand at that time, even assuming a slow 2.5–3 percent annual growth in Soviet energy requirements as a whole. This amounts to a significant quantity and proportion, but only half would represent new savings, since some 60 million standard tons of SER are already recovered today.

[42] A.M. Nekrasov and M. G. Pervukhin eds., *Energetika SSSR v 1976–1980 godakh* (Moscow: "Energiia," 1977), p. 78.
[43] Sushon *et. al., op cit.*, pp. 250–65.
[44] *Narodnoe khoziaistvo SSSR v 1978 godu*, pp. 44 and 144.

The further growth of cogeneration, on the other hand is expected to be less rapid than formerly, especially in the European USSR. West of the Urals, the continued expansion of dual-purpose capacity is restrained by developments both on the base and on the peak sides of the load curve. Incremental base load capacity is increasingly satisfied by nuclear plants, which by their current design and sitings are not capable of waste heat recovery. The use of heat and power reactors for district and industrial heating is at least 15 years away and their deployment would add to but not replace atomic stations on stream or under construction today.

Continued expansion of cogeneration is also restrained by declining load factors, caused by the electrification of agriculture, auxiliary operations in mining, construction and industry plus other sectors with irregular consumption. Demand fluctuation is already a serious problem, since the Russians have an acute shortage of appropriate units to cover peak and intermediate loads. In the mid-1970's, for example, peaking and semi-peaking units comprised only 22 percent of all capacity in the Unified European Grid and this share is expected to decline to 18–19 percent in the future.[45] When the further problem of mismatch for the respective load curves of heat and power are added (night peaks for the former, daily peaks but night off-peaks for the latter during the heating season), it becomes clear that the built-in rigidities of a dual regime will limit the growth of cogeneration.

Recent articles in the technical journals attest to the search for greater flexibility. In large part this may be achieved through some decoupling of heat and power production and existing TETsy (i.e., cogenerating stations) and the construction of new ones with lower heat loads. A survey of almost three dozen existing TETsy, comprising 35 percent of cogenerating capacity, is claimed to reveal the technical possibility of decreasing their nightly power load by an average of 42 percent.[46] The reconstruction and/or deplacement of obsolete dual purpose turbines, two-thirds of which work at very low pressure and are over 30 years old (they accounted for 24 percent of TETsy capacity in 1975) should also result in some reduction in joint heat and power generation.[47]

The further development of centralized heat supply via steam, both from TETsy and from district steam plants without electricity, is still urged. Indeed, it is regarded as economically pressing because of the low efficiency of stoves still dominant in the household-municipal sector and of small, poorly designed boilers frequent in small-town industry and that of remote regions. As mentioned above, individual stoves consumed over 70 percent of all fuel used by the household-municipal economy in 1975, more than two-thirds of this being coal, lignite, peat and wood. Yet, progress is admitted to be slow. Cogenerated heat and power, in particular, experienced drastic declines in average yearly growth rates during the seventies when compared to the previous decade. In case of power produced at such plants, even the average increment dropped sharply after 1970. By contrast, condensing stations, not to mention nuclear plants, which

[45] *Elektricheskie stantsii*, No. 3 1978, p. 8.
[46] *Elektricheskie stantsii*, No. 8, 1979, pp. 13–17, esp. p. 16.
[47] *Teploenergetika*, No. 4, 1979, pp. 18–19. To cover the peak load for heat, auxiliary boilers which produce no electricity must be relied on. A large TETs may have several of these. William Diskant, "USSR Trip Report," *District Heating*, No. 3 (Jan., Feb., March) 1979, pp. 12–17.

bleed-off no steam for heating and industrial processes, increased production at an accelerated rate and by rapidly widening increments.[48]

Apparently the only regions where cogeneration has noticeably raised its relative contribution to heat and, probably also electricity, supply during the decade just ended were Siberia and the Far East, especially the latter. In Siberia the share of TETsy in residential-municipal heat grew, but in total urban heat it remained constant, indicating a decline in their importance for industrial enterprise.[49] In the Asian parts of the Russian Republic, Soviet sources claim an economic advantage for cogeneration even at a much smaller scale, e.g., in smaller settlements, than in the European USSR, because of the very low economic efficiency of decentralized heat from small boilers and stoves fired primarily by unsorted and poor quality solid fuels. The claim appears valid and dual purpose stations may assume a greater role in these eastern provinces, especially beyond the Kuzbas. Such a development, however, would not save much in way of hydrocarbons, which in 1975 contributed less than 6 percent to heat supply in East Siberia and 16 percent in the Far East, inclusive of that furnished via cogeneration itself. Indeed, the planned 1976–1980 growth rate for gas and oil as a source of heat in the Asian RSFSR well exceeds that for coal, though we do not know how they were affected by the actual performance of the industries involved.[50]

5. Administrative Measures and Pricing Policies

In the Soviet economy production processes are (or should be) coordinated primarily by directives, plans and command. Not surprisingly, therefore, administrative measures have assumed a central role in the effort at conservation. Concurrently, all the familiar devices of campaignology used to expand supplies are now employed to foster more careful consumption and reduce unessential demand. The phrase, "Berech' toplivo, energiiu i materialy!" (or in rough translation "Be sparing with fuels, energy, and materials!") today leaps at one from almost every issue of Soviet newspapers. Enterprises, institutions, organizations are pressured and, in most cases, ordered from above to submit proposals and plans for energy conservation. Administrative measures may be aimed at conservation in the physical sense, by reducing supplies to sectors of final demand and in some cases by making consumption illegal and subject to punishment. Alternately, they may be intended to improve technical coefficients, i.e. the input-output efficiency of the economy.

Given the continued military build-up, defense is unlikely to have suffered from any cut back in energy allocation to final demand so far. We lack all data, however, and any speculation along this line would be pointless. On the other hand, there is no doubt that the civilian consumer, long the target of such "conservation", is still the first to feel the pinch. Soviet planes fly when full (and when available), not by the fictitious time-table, library alcoves with 100 watt bulbs are exceedingly rare (I have never used one in the USSR), yearly allocation of

[48] Robert Campbell, *Basic Data on Soviet Energy Branches* (Santa Monica, Cal.: Rand Corporation. Research Note N–1332–DOE, December 1979), pp. 18–20. See also Teploenergetika, No. 12, 1978, p. 3.
[49] *Teploenergetika*, No. 2, 1979, pp. 10–12.
[50] *Ibid.*, pp. 10–15.

new passenger cars to consumers remained unchanged for the past four years and declined slightly per million inhabitants.[51] When in the winter of 1978–79, the flow of gas from Iran was curtailed, the household-communal economy of Transcaucasia reportedly suffered more than industrial consumers. And as noted above, the unauthorized use of a mere 6,500 tons of liquid fuels in Tadzhikistan for home heating and hot water quickly brought on retribution.[52]

Yet these measures have their limits. Fuels delivered by discontinuous media through official channels can be curtailed. But pentup demand, combined with the dispersed nature of such consumption, provides fertile soil for a flourishing illegal market which is impossible to police. Long-haul trucking and the 47,000 collective farms, covering the entire arable portion and much of the pasture land of the USSR, for example, are prominent leaks through which gasoline enters the black market. An article in *Sovietkaia Rossiia* claims that only 57 percent of the estimated 105,000 tons of gasoline consumed by private cars in Rostov Oblast per year is sold through filling stations. The rest "escapes" chiefly from the trucking organizations.[53]

On the other hand, energy, such as electricity and pipeline gas, delivered to the consumer via continuous media that supply industries as well cannot be curtailed. Administrative measures for overconsumption must be applied *ex post*, but overconsumption must first be ascertained by proper instruments installed at the place of demand. Such metering devices are in woefully short supply in the USSR and frequently lacking even for industrial consumers that use much larger quantities than households. Altogether 5 million gas-burning furnaces, fireplaces and stoves are claimed to exist where the fuel is consumed without any metering whatsoever.[54] I myself visited a home in a provincial town where in winter the flame on the gas stove was burning day and night. Heat furnished to buildings from cogenerating stations and district boilers is not metered at the consumer end at all but regulated only from the plant. The poor design of apartment blocks and the familiar chimney effect guarantees overheating and open windows in many households even as some shiver. In addition, diversion of hot water from radiators for domestic needs is reportedly common ("an every day story") and a simple matter for ingenious tinkerers who abound in the Soviet Union.[55]

Finally, fuel consumption in households is a function not only of personal decisions but of the age and efficiency of equipment as well, over which the vast majority of Soviet families have no control. With respect to gas furnaces in the domestic sector an efficiency range of 15 to 50 percent is reported, even the upper limit being very low by Western standard.[56] A vast program of reequipment would be needed to improve the situation, but it is not in the wind. In addition, a number of the most varied organizations, belonging to several ministries, participate in the design, construction, installation, adjustment and in-

[51] See Toli Welihozkiy, "Automobiles and the Soviet Consumer," in U.S. Congress, Joint Economic Committee, *Soviet Economy in a Time of Change* (Washington: U.S. Government Printing Office, 1979), Vol. I, p. 820 for 1977–78 allocation. 1979 production and export from *Ekonomicheskaia gazeta*, No. 5 (January 1980), p. 8.

[52] *Kommunist Tadzhikistana*, June 26, 1979, p. 1.

[53] *Sovetskaia Rossiia*, October 19, 1979, p. 2.

[54] *Pravda*, November 18, 1979, p. 2.

[55] *Izvestiia*, June 5, 1979, p. 2. Clever thefts of electricity for domestic use have also been reported. E.g. *Izvestiia*, March 28, 1979, p. 3.

[56] *Izvestiia*, June 29, 1979, p. 2.

spection of gas using equipment in households. They lack common standards and coordination, and serving the domestic sector is often very low on their scale of priorities.[57]

Administrative measures to improve input-output efficiency are directed not at final purchasers but at intermediate sectors of the economy. Essentially, they involve the tightening of allocation norms per unit of output, i.e., the reduction of input-coefficients, and are thus examples of conservation in the economic sense of the term. Such reductions apply not only to energy inputs directly, but also to material inputs, through which savings of energy and other resources are indirectly accomplished. Since the use of allocation norms is essential in the planning process and is widely employed to begin with, stricter norms would, at first blush, yield real and calculable energy savings.

In fact, as students of Soviet type economies are well aware, such norms in large degree depend on information and proposals from below and are therefore affected by the interests of those concerned. In addition, the size and complexity of the Soviet economy, the wide variations in the type and, still more, the age of equipment and technologies even in the same branch result in a very large number of norms and consequent opportunities for padding by those who supply the information. The Central Computation Center of Gosplan, for example, employs 270,000 different material norms in preparing the annual plans,[58] but this is still very far from expressing the full range of input coefficients in that vast economy. And in industry, too, shortage of metering devices is a serious problem, which further confounds any attempt at establishing meaningful standards of energy use for the wide range of equipment in place.

Thus, by Soviet account, the way energy consumption norms are established has nothing to do with "scientific principles" or the best domestic or foreign experience. They are set entirely by trial and error, by the familiar bargaining process between enterprises and superior agencies. So great energy wasters can boast of great "savings" and be, in fact among the leading "economizers." [59] One source cites the example of 29 firms for which not even such "seat of the pants" norms exist. Yet the ministry to which they belong planned for them precise quantities of savings for fuel and heat (1833 standard tons and 15,500 Giga calories respectively), though no one could say where these figures came from. Of 2500 enterprises under 7 ministries inspected, all of them claimed significant conservation in gas consumption, though on close examination most of these savings have turned out to be fictitious.[60]

Lack of communication and coordination among departments, so prevalent in the USSR, further complicates energy accounting and hinders the implementation of conservation measures. An especially alarming situation is reported from the construction project of Siberia and the Far East, where distance and isolation has led to hoarding

[57] *Sotsialisticheskaia industriia,* November 2, 1978, p. 2.
[58] *Ekononicheskaia gazeta,* No. 29 (July 1978), p. 17.
[59] *Pravda,* January 8, 1979, p. 2 and Ekonomicheskaia gazeta, No. 23 (June 1979), p. 5.
[60] *Sotsialisticheskata industriia,* August 25, 1979, p. 2. See also S. Veselov, "Ratsional'no raskhodovat' toplivno energeticheski resursy," *Planovoe khoziaistro,* No. 2, 1979, p. 36. The latter source also reveals that for 85% of the enterprises belonging to the Ministry of Light Industry the norms for energy expenditures were set above actual per unit expenditures of the previous year. *Idem.*

and overconsumption of fuel, especially motor fuel, much greater even than usual elsewhere in the USSR.[61]

Although prices in the inter-industry sector of the Soviet economy are not used as a direct instrument of resource use and allocation, in private consumption their influence is undeniable. The fact that gasoline prices have been raised sharply in recent years does show that the leadership is willing to employ them to dampen consumption, at least insofar as the scarcest and most valuable fuels are concerned. For electricity, too, Soviet households pay a far higher unit rate than industrial and commercial consumers. These rates are not too far below the average in the United States (perhaps 7 cents per kWh, though over 12 cents in New York) and are unlikely to be subsidized (table 3). It is certainly possible that they will increase in the future.

TABLE 3.—ELECTRICITY PRICE PER KILOWATT-HOUR

[In kopeks based on 1973 electricity rate]

	Domestic lighting and household needs	Large industry[1]	Small industrial consumer[2]	Nonindustrial[3]
Moscow	3.882	NA	2.5	2.505
Kuibyshev	3.77	1.245	2.525	2.417
Sverdlovsk	3.65	1.182	2.5	2.5

[1] Over 1,000 kW installed capacity.
[2] Up to 100 kW installed capacity.
[3] Nonindustrial consumers, nonproductive commercial, social, and educational enterprises.

Source: A. Iu. Leonidovich, "Osnovnye puti sovershenstvovaniia planirovaniia i ekonomicheskogo stimulirovaniia v energetike," unpublished dissertation (Moscow: Ordzhonikidze Engineering-Economic Institute, 1975), pp. 198–199 and p. 201.

In contrast, other utilities, except telephone, are included in the rent of state owned and even cooperative apartments in urban areas and this rent is heavily subsidized indeed. Theoretically, utilities could be excluded from rent and priced separately, but under Soviet conditions, the move today would make little sense. In 1975, more than two-fifths of urban household and municipal heat was derived as hot steam from cogenerating and district heating plants (with the 1980 Plan, which could not be reached, calling for 52 percent).[62] As mentioned, centralized heat is regulated at the plant. No equipment is available to meter it at the consumer's flat and, at any rate, such plants are unable to adjust to swift and/or incremental changes in demand. Nor is it likely that household and municipal users of the approximately 5 million gas furnaces and stoves unfitted with meters could be soon provided with them.[63] Only 20–25 percent of the orders for various heat and power controlling and metering instruments in the Kuzbas during 1978 were fulfilled.[64] And given the enormous range but very low overall efficiency of home furnaces, concentration on refitting and reequipment most likely would yield greater benefits.

Finally, given the shortage and poor quality of consumer goods and the lack of private investment opportunities in the USSR, the vastly

[61] *Stroitel'naia gazeta,* August 8, 1979, p. . . 1 and *Finansy SSSR,* No. 5, 1979, pp. 43–45.
[62] *Ryps, op. cit.,* p. 19 and *Teploenergetika,* No. 2, 1979, Table 2, p. 12. Computed from Tables 8, 9, 10 in Ryps, *op. cit.,* pp. 18–20.
[63] *Pravda,* November 18, 1979, p. 2.
[64] *Ekonomicheskaia gazeta,* No. 23 (June 1979), p. 5.

increased liquidity of the Soviet public should dampen the price elasticity for energy, particularly gasoline, but probably also for natural gas and electricity. In addition to the 131 billion rubles held in saving accounts at the end of 1978 (54 percent of the value of all retail sales),[65] perhaps half as much money may have now accumulated in the hands of the population.[66] In addition, a large portion of the private cars (emigre opinion puts it as high as one-half) are used for illegal but very lucrative business involving considerable driving. For such car owners, higher prices for gasoline, would obviously have little impact on conservation.

Conclusion

In conclusion let me simply summarize some points made in the Introduction and elaborated in the paper. Energy conservation in the USSR represents a mixture of arbitrary attempts at physical preservation and efforts at greater economic rationality concerning resource use and efficiency. The former means a restriction on consumption independent of its social-economic impact; the latter involves, *ceteris paribus*, increasing energy efficiency in use and improved functional and sectoral allocation of the different energy forms. Over the long haul, even structural changes in the economy and locational shifts of consumers themselves should become part of the allocative process.

Given the organization and institutional framework of the Soviet economy, it is not surprising that administrative measures, combined with the familiar trappings of "campaignology," assumed the central role in energy conservation. They are employed both to withhold scarce resources from low priority sectors, particularly the final consumer, and to lower input coefficients both by raising energy efficiency and/or by improving functions, sectoral and regional allocation.

In the Soviet environment, such administrative measures in the past have proven most successful *vis-a-vis* the final consumer (and low priority supplying sectors) and I expect this situation to continue. However, in the past two decades the range of low priority consumers has narrowed considerably. Agriculture now enjoys preferential allocation and given the demographic situation, the household communal sector, too, may become a more important claimant on the country's energy resources. At any rate, the current modest demand on state supplied energy, especially hydrocarbons, by the final consumer, the importance of cogeneration and district heating, the extreme shortage of metering devices and a flourishing and hard-to-control black market, particularly for gasoline, all militate against substantial energy saving by the population.

Administrative measures aimed at the big energy consumers and wasters in the inter-industry sector are even less likely to be successful, though it is here that really substantial economies would have to be attempted. In a large economy, with extreme variations in the age and type of equipment and processes and faced with a severe shortage of metering instruments, such measures would be very poor tools in improving input coefficients over broad fronts, even without the obstacles built into the institutional web of the Soviet economy. By

[65] *Narodnoe Khoziaistvo SSSR* v 1978 godu, pp. 415 and 435.

[66] See the very interesting article by Igor Birman, "The Financial Crisis in the USSR," *Soviet Studies*, January 1980, pp. 84–105, especially 85–86. Birman estimates that a *minimum* of 50 billion rubles of cash was accumulated by the end of 1975.

Soviet admission, the way energy consumption norms are set has little to do with scientific principles, best practice examples or the requirements of the specific equipment on hand. So a great deal of energy saving has turned out to be entirely fictitious.

I have also shown that, on the whole, Soviet planners have failed to decouple economic growth from increased energy consumption. By Soviet calculations, *net* energy use per ruble of national income remained virtually constant over the past quarter of century and sectoral changes in the economy had virtually no net impact on energy demand. *Aggregate* energy input (i.e., the demand for raw fuels, hydro and nuclear electricity) per unit of GNP declined primarily because of improvement in the fuel balance and in certain additional conversion and utilization technologies independent of the fuel mix. Because these opportunities are now coming to an end, I argued and continue to maintain, that *at the margin at least*, technological progress in increasing energy efficiency in the USSR will slow down considerably in the future. Average system efficiency may continue to improve as obsolete equipment is replaced, but given the slow retirement rate of fixed capital and the worsening accessibility and quality of natural resources, such progress will be slow. Without major structural and systemic changes in the Soviet economy, economic growth and energy consumption cannot be decoupled to any significant extent. Indeed, over the past decade, the relationship between the rise of GNP and energy demand has been almost one to one.

The structural, geographic and technological constraints on fuel substitution were detailed elsewhere and were only touched on here. However, the paper has shown that, besides other obstacles, cogeneration and nuclear power are also facing very serious structural constraints imposed by the load curve. The growth of cogeneration has already slowed down and nuclear electricity, unless coupled with a heating function (a still unsolved problem), will also meet this barrier in about a decade. In the meantime, atomic power may be able to cover the *increment* in electricity demand west of the Urals. It cannot reduce the huge quantities of hydrocarbons burned as boiler fuels today.

To sum up, energy conservation is as crucial an issue for the USSR as for the Western World and is clearly receiving strong emphasis. With sharply rising production and transport cost for additional output, the claim that per energy unit, conservation costs little more than half as much as new supplies appears reasonable.[67] In the Soviet Union, however, energy consumption has much stronger structural, institutional and geographic ties with the sinews of the economy, with high priority sectors, than in most Western countries. Given these rigidities, and the Soviet system of economic management and planning, it is my view that the Soviet Union will be less able than Western nations to check the increase of energy demand without affecting economic growth. While other, and possibly even more important, factors are certainly at work, the extremely poor performance of a host of heavy energy consuming branches in the last few years must have a direct link with the severe problems in the energy sector and the rather ineffectual results of conservation measures so far.

[67] Nekrasov, division chief of the USSR Gosplan, in *Material'no-teckhnicheskoe snabzhenie*, No. 3, 1979, pp. 60–61.

VI. SOVIET PETROLEUM PROSPECTS: A WESTERN GEOLOGIST'S VIEW

By Joseph P. Riva, Jr.*

1. History

The Caucasus and the Caspian Sea

Before World War II, about 80 percent of Soviet oil output was derived from the Caucasus, where commercial production began in the 1870's at Baku in Azerbaijan. By 1940 national oil production had reached 229 million barrels, 163 million of which came from Baku.[1] Baku, however, subsequently declined and never recovered its prewar peak. Groznyy, discovered in 1890, peaked at 159 million barrels in 1972 and then declined rapidly to about 51 million barrels in 1977. The peak was due to the discovery in the late 1950's of new reserves in deeper Cretaceous strata below the previously productive Miocene. The Soviets projected continuously high Cretaceous production based upon the successes of the 1960's and the 9th five year plan set a 1975 goal of 184 million barrels. Actual production from Groznyy in 1975 was about 66 million barrels.[2]

Although the Baku and Groznyy fields were not seized during the war, wartime exploration lagged and production declined. In an effort to restore Baku production, which had dropped to less than one-half of its pre-war magnitude, the Soviets began the development of the offshore Caspian Sea fields. The first giant offshort field began production in 1951. The field (1.05 billion barrels) was at Neftyanyye Kamni, a reef area about 25 miles east of the Apsheron Peninsula of Baku. The field peaked at 51 million barrels in 1970. A second offshore field, Duvannyy-Bulla, replaced Neftyanyye Kamni as the leading Caspian producer in the early 1970's. However, offshore development in the Baku region was not able to compensate for declining onshore production and total Azerbaijan output (and production goals) continued to fall.[3]

This decline continued until the development of the inland Muradkhanly field in 1977 which stabilized Azerbaijan production. The Baku region, which had been the world's dominant producer at the turn of the century, currently provides less than five percent of Soviet oil output and will not again play a major producing role.[4]

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[1] Dienes, Leslie and Theodore Shabad. The Soviet Energy System: Resource Use and Policies. V. H. Winston & Sons, Washington, D.C. and John Wiley & Sons, New York, 1979, p. 50.

[2] *Ibid.*, p. 51.

[3] *Ibid.*

[4] *Ibid.*, p. 52.

The Volga-Urals

The Baku-dominated phase of the Soviet oil industry came to an end in the mid-1950's with the development of the Volga-Urals province where the first oil discovery had been made accidentally in 1929 while exploring for potash. Commercial production in the province (an area between the Volga River and the Ural Mountains) began in 1932 at Ishimbay. The early discoveries were in relatively shallow Permian and Carboniferous rocks and were limited in productive capacity. The most productive reservoirs were later found to be in deeper Carboniferous and especially Devonian strata.[5] Dominant among the fields discovered in the Volga-Ural area was Romashkino, a super-giant containing an estimated 14 billion barrels of oil.[6] With the discovery of Romashkino in 1948 at Al'met'yevsk in Tatar ASSR, the center of production began shifting to the Volga-Urals. In 1955 the Arlan field (2.8 billion barrels) was discovered in northwest Bashkiria.

By 1949 the expanding Volga-Urals production had compensated for the decline of the old Caucasus fields. In the mid-1950's the three leading producing regions of the Volga-Urals (Tatar ASSR, Bashkir ASSR, and Kuybyshev Oblast) had each surpassed the output level of Baku and had become, respectively, the first, second, and third leading oil producing areas of the Soviet Union.[7]

By 1961 increased Volga-Ural production had raised the Soviet Union to the second ranking oil producing nation (behind only the United States). In the mid-1960's the region accounted for over 70 percent of Soviet production. The beginning of oil operations in West Siberia reduced this percentage after 1965, but production did not peak in the Volga-Urals until 1975 when the Tatar ASSR reached its record production level of 764 million barrels.[8] Of this amount, the super-giant Romashkino produced 580 million barrels, or 76 percent, illustrating the critical importance of super-giant oil fields to a producing region. Since 1975, production from the Volga-Urals province has been in decline.

Also in the 1970's, oil output peaked in a number of other lesser Soviet oil producing provinces. These include the Belorussian and Ukrainian republics in European Russia, and Kazakhstan and Turkmenia.[9]

West Siberia

European Russia (Caucasus, Caspian Sea, and Volga-Ural areas) dominated Soviet oil production into the 1960's. In the early 1960's, European Russia still accounted for 93 percent of Soviet oil production. The penetration of West Siberia began in 1960 with oil discoveries in the Shaim district of the Konda River Valley. This has turned out to be the farthest producing area to the west thus far discovered in West Siberia, with a modest production of about 37 million barrels

[5] *Ibid.*
[6] Nehring, Richard. The Outlook for World Oil Resources. Oil and Gas Journal, October 27, 1980, p. 172.
[7] Dienes, Leslie and Theodore Shabad., op. cit., p. 52.
[8] *Ibid.*
[9] *Ibid.*, p. 53.

per year.[10] The focus of exploration then shifted to the area around the Middle Ob' River valley, some 350 miles to the east, with the discovery of the giant Ust' Balyk field (2.3 billion barrels) southwest of Surgut. The first oil from the Middle Ob' region was produced in 1964. Between 1961 and 1969 an intensive exploration effort identified 59 fields in the Middle Ob' region, including the super-giant Samotlor (in 1966) which contained some 14.5 billion barrels of oil. It is the largest field yet discovered in the Soviet Union and of the same order of magnitude as Romashkino, long the mainstay of Volga-Ural production. Other giant fields discovered, mainly in the area around Surgut, included West Surgut (730 million barrels), Pravdinsk (950 million barrels), and Mamontov (1.75 billion barrels).

During the 1971–1975 five year plan the development of the West Siberian basin fields was dominated by the exploitation of the super-giant Samotlor.[11] During that time this one field accounted for 66 percent of the production increase in West Siberia and 55 percent of the entire Soviet growth.

In the second half of the 1970's the development effort had to be shifted away from the Ob' valley and its large fields as more remote fields in the swampy woodlands of the West Siberian plain were brought into production. The rate of development slowed as less accessible sites were developed. This expansion proceeded northward from the Middle Ob' valley and also to the southeast in the Vasyugan Swamp of Tomsk Oblast.

Soviet oil production in 1979 was 4.271 billion barrels. Of that total 2.066 billion barrels came from West Siberia, with Samotlor contributing 1.100 billion barrels. Output in the Volga-Urals in 1979 was 1.471 billion barrels with a declining Romashkino contributing 500 million barrels to that total. Thus, the West Siberian basin supplied 48 percent of total Soviet oil output and Samotlor accounted for 53 percent of West Siberian oil. Samotlor produced 26 percent of total Soviet oil, while Romashkino added an additional 12 percent. Together these two super giants accounted for 38 percent of total Soviet production, which led the world.

2. Discussion

The Soviet Union has a long history of oil production. A normal progression has occurred as several oil provinces were discovered, became dominant in production, and then declined. Development before World War II was gradual as demand was low and technology limited. Exploration and production began in the Caucasus before 1900 and this rather modest province was the major domestic supplier until after World War II, accounting for 80 percent of Soviet production in 1940. The amount was moderate, the 229 million barrel total is only about one-fifth of Samotlor's current production. The Caucasus could not maintain production indefinitely and after the war it was necessary to explore and develop the oil fields of the Caspian

[10] *Ibid.*, p. 57.
[11] *Ibid.*, p. 58.

Sea. Some large fields were put in production, but they were not able to compensate for declining output onshore.

The next province to be exploited was a giant. Known recoverable oil resources in the Volga-Ural province have been estimated at 40 billion barrels, making it the third largest oil province in the world.[12] The super giant field that made this province so prolific is Romashkino, which contained about 35 percent of the provinces' oil. And yet, this province, while quickly raising the Soviet Union to the second ranking oil producer, peaked in 25 years and in 15 years required assistance from West Siberia to maintain nation-wide production increases. Also, it should be noted that Romashkino was discovered rather early in the exploration cycle of the Volga-Ural province.

The West Siberia oil province is another giant, ranking fourth in size in the world (behind the Volga-Ural province) with known recoverable oil resources estimated at 37 billion barrels.[13] The super-giant Samotlor contained about 39 percent of this oil resource. The rapid exploitation of the third and fourth ranking oil provinces in the world (and specifically of the super giants Romashkino and Samotlor) propelled the Soviets into a position as the world's leading producer in 1974. The 1971–75 five year plan concentrated on the successful development of Samotlor. The same plan, however, set a 1975 goal of 184 million barrels of oil from Groznyy (in the Caucasus), a projection that was more than double the production that was actually achieved. In the second half of the 1970's an expanding Siberia and a declinind Volga-Ural province have kept the Soviet Union the leading oil producer state in the world and have provided continuingly increasing production to a record level in 1979 of 4.271 billion barrels.

3. Projections

There have been numerous projections of Soviet oil production into the future. The Soviet goal for 1979 of 4.329 billion barrels of crude oil and condensate was not achieved. The revised goal for 1980 is 4.453 billion barrels, and the goal for 1981 is 4.490 billion barrels, perhaps indicating a leveling off in expectations.[14]

While it is not possible to estimate future Soviet oil production to within a fine degree of certainty, it is possible to put future production into a perspective by using past Soviet production performance and also the experience gained in other oil provinces throughout the world. This is best illustrated by using a projection of essentially level (12 million barrels per day or 4.38 billion barrels per year) Soviet production. Since the estimates regarding future Soviet oil production range from sharply dropping to rising, this level of production might be regarded as being a rather conservative choice. It might be reasoned that with technological advances and a very large land area, the Soviets surely should not do any worse in the future than they have done in the past. That level production for the next ten or twenty years is a very optimistic projection will be argued. However, it is first necessary to look back on the last decade during which time the Soviets achieved a

[12] Nehring, Richard., op. cit.
[13] Nehring, Richard., op. cit.
[14] Oil and Gas Journal, October 27, 1980.

remarkable increase in oil production. Using reserve and production data from the past ten issues of *World Oil*, several items are of interest:

1. Soviet production increased from 2.555 to a world record 4.271 billion barrels per year between 1970 and 1979.

2. Proved reserves increased from 58.000 billion barrels to only 59.787 billion barrels during the same time period.

3. Thus, the reserves/production ratio (a measure of the rate of production) decreased from 23/1 to 14/1. The Soviets were exploiting their oil reserves at almost twice the rate at the end of the decade that they were at its beginning.

4. Total additions to reserves during the 1970's were 36.23 billion barrels (an average of 3.623 billion barrels per year). This can be compared to reserve additions of 28.07 billion barrels for the United States, where production declined during that same period.

It can be seen from the above that the increases in Soviet production were largely derived from the decrease in reserves/production ratio. While slightly more oil was found than produced during the past decade, the largest increases in production were achieved by producing oil that was mostly found during the 25 years that preceded 1970.

The reserves/production ratio of 14/1 is a normal ratio for a country not yet intensively developed. The world average is about 28/1, but this includes several large producers that conserve their oil reserves at the expense of current earnings. A ratio of 10/1 appears to be about the maximum annual withdrawal rate permitted by the physical properties of oil reservoirs without risking a loss of ultimate production. The United States (with a current reserves/production ratio of 9/1) is the only significant producer country that depletes its oil reserves at a faster rate.

When projecting a 12 million barrel per day (4.38 billion barrel per year) Soviet crude oil and condensate production into the future, two possibilities will be discussed: Production for twenty years at the current reserves/production ratio of 14/1; and production at a ratio which decreases to 10/1 by 1989.

To maintain production at around the current 4.38 billion barrels per year with a reserves/production ratio at the present 14/1, would require that as much oil be added to reserves as is produced. This would mean that an average of about 4.38 billion barrels would have to be added to reserves each year during the next two decades. As has been previously pointed out, an average of only 3.623 billion barrels of oil was added per year during the last decade. Thus, considerable more oil will have to be found in the next decade to stay even than was found in the last decade which was marked by a remarkable increase in production. To stay even in the 1980's would require 43.8 billion barrels of reserve additions, 7.6 billion barrels more than was found in the 1970's.

However, there is always the option, which was exercised in the 1970's, that existing reserves can be produced at increasingly faster rates to raise output. The limit is a reserves/production ratio of about 10/1. This possibility is illustrated in the following table, with reserves/production ratios declining to 10/1 by 1989.

LEVEL SOVIET OIL PRODUCTION FOR THE NEXT 20 YR WITH DECLINING RESERVES/PRODUCTION RATIOS TO 10/1

[In billions of barrels]

Year	Reserves	Reserve additions	Production	Reserves/production ratio
1979	59.79	5.62	4.27	14/1
1980	59.57	4.16	4.38	13.6/1
1981	57.82	2.63	4.38	13.2/1
1982	56.06	2.62	4.38	12.8/1
1983	54.31	2.63	4.38	12.4/1
1984	52.56	2.63	4.38	12.0/1
1985	50.81	2.63	4.38	11.6/1
1986	49.06	2.63	4.38	11.2/1
1987	47.30	2.62	4.38	10.8/1
1988	45.55	2.63	4.38	10.4/1
1989	43.80	2.63	4.38	10/1
1990	43.80	4.38	4.38	10/1
1991	43.80	4.38	4.38	10/1
1992	43.80	4.38	4.38	10/1
1993	43.80	4.38	4.38	10/1
1994	43.80	4.38	4.38	10/1
1995	43.80	4.38	4.38	10/1
1996	43.80	4.38	4.38	10/1
1997	43.80	4.38	4.38	10/1
1998	43.80	4.38	4.38	10/1
1999	43.80	4.38	4.38	10/1

It can be seen from the table that a decreasing reserve/production ratio allows level production with smaller reserve additions. A reduction in this ratio to 10/1 during the decade of the 1980's will require the discovery of 27.81 billion barrels to achieve level oil production. This is less than the 36.23 billion barrels found during the 1970's and considerably less than the 43.8 billion barrels needed to stay even for the 1980's at the current 14/1 ratio. However, when the 10/1 barrier is reached then as much oil will have to be found as is produced. At this point reserve additions must average 4.38 billion barrels per year to produce 4.38 billion barrels of oil per year.

To increase its production or even to stay even the Soviet Union needs to increase its reserve additions over those of the past ten years, or to use its rigs to drill field wells in existing fields to produce them faster. New discoveries will have to be very large fields to be produced fast enough to impact the next decade, given the lead times in the vast frontier areas of the country. The state of Soviet technology in offshore development all but precludes significant offshore Arctic production during this century, but new large fields are more likely to be found in such remote undrilled areas.

An indication that the Soviets may expect reserve additions to decline at least in the next five years is contained in a statement by the deputy chairman of a state planning committee to the effect that while the average new Siberian well yielded 679 barrels per day during 1976–80, in the next five years (1981–85) this will drop by 60 percent to 277 barrels per day per well. This drop is ascribed to less favorable geologic prospects in the new, more remote areas and smaller West Siberian fields being developed.[15] If this proves to be the case and reserve additions fall below those of the past decade, production can only stay level for a time by increasing production rates in existing

[15] Oil and Gas Journal, Newsletter, June 9, 1980.

fields. Then the general decline that will follow will be even steeper because of the depleted reserves.

Any discussion of future Soviet oil production potential should include a mention of undiscovered resources. This is especially important in the West Siberian Basin. The U.S. Geological Survey, in an open file report, estimated that the total recoverable oil in the West Siberian basin could be 80 billion barrels (making it the second largest oil province in the world.) [16] This assessment was made on the basis of a basin analogue. The West Siberian basin is a Cratonic Type II basin. Such basins in other areas of the world have been found to yield from 40,000 to 170,000 barrels of oil per cubic mile of sediment. The average is 100,000 barrels of oil per cubic mile of sediment. It was assumed in the Geological Survey report that the "incomplete exploration" and "apparent richness" of the West Siberian basin would merit the use of the maximum yield in hydrocarbon resource calculations. Thus, the high amount (170,000 barrels of oil per cubic mile of sediment) was used to derive the 80 billion barrels of recoverable oil figure. Since Cratonic Type II basins have the highest percentage of natural gas (65 percent), this factor was also included in the calculation. It does appear that a high percentage of the hydrocarbons present in the West Siberian Basin do occur as natural gas.

Exploration has been underway in the West Siberian basin for 20 years and many large structures have been drilled. While most of the largest have been found to contain gas, 37 billion barrels of oil has been discovered. If the 80 billion barrels of recoverable oil estimated by the Geological Survey proves to be correct, there is an additional 43 billion barrels to be discovered. However, if the basin has been well explored during the past 20 years (and the giant fields are usually found early), the 37 billion barrels discovered would indicate that it is representative of average Cratonic Type II basins rather than of the most prolific ones. Recovery would then be expected to be about 100,000 barrels per cubic mile, or 47 billion barrels. Thus, just 10 billion barrels would remain to be found in the West Siberian basin.

However, even if the highest recovery figure is correct and 43 billion barrels remain to be found, about that amount (43.8 billion barrels) would be required to maintain the current 12 million barrels per day production for just 10 years, without a further reduction of the reserve/production ratio. Even at the highest recovery yield, there would not be nearly enough undiscovered West Siberian oil to maintain 12 million barrels per day production for 20 years, even if the reserves/production ratio were reduced to 10/1. Thus, a new giant petroleum basin is neded. Even if such a basin exists (perhaps offshore in the Arctic or in Eastern Siberia) the lead times would be such as to preclude production in this century.

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[16] Clarke, James W., Oswald, W. Girard, Jr., James Peterson, and Jack Rachlin. Petroleum Geology of the West Siberian Basin and a Detailed Description of the Samotlor Oil Field. Open-file Report 77-871, U.S. Geological Survey, Reston, Virginia, 1977, p. 116-119.

VII. GENERAL PRINCIPLES OF THE PETROLEUM INDUSTRY AND THEIR APPLICATION TO THE U.S.S.R.

By David H. Root and Lawrence J. Drew*

To form an opinion of the future of the Soviet oil industry from the limited information available, it is helpful to have a general idea of how oil production has evolved in other areas for which more detailed information is available; this is so because the evolution of oil production is controlled by principles that hold equally well regardless of a country's social organization. Three principles will be discussed.

Principles

(1) For most purposes oil and natural gas are generally preferred to coal as fuels.
(2) Most oil is contained in a few large fields, although most oil fields are small.
(3) As exploration of a sedimentary basin progress, the average size of oil and gas fields being found decreases dramatically as does the amount of oil and gas found per unit of exploration.

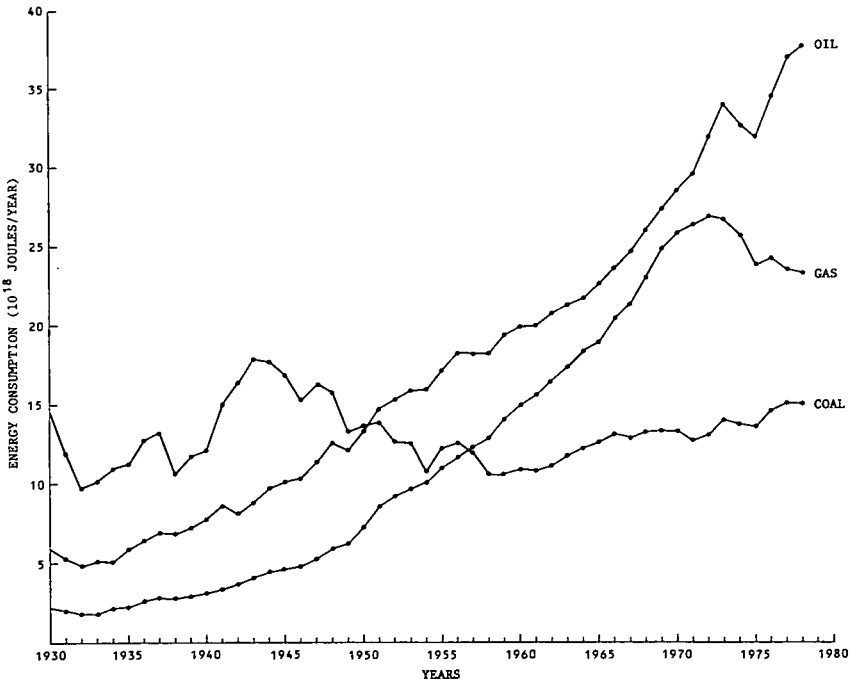

Figure 1.—United States energy consumption, 1930–78, from oil, gas, and coal (DeGolyer and MacNaughton, 1979, p. 104)

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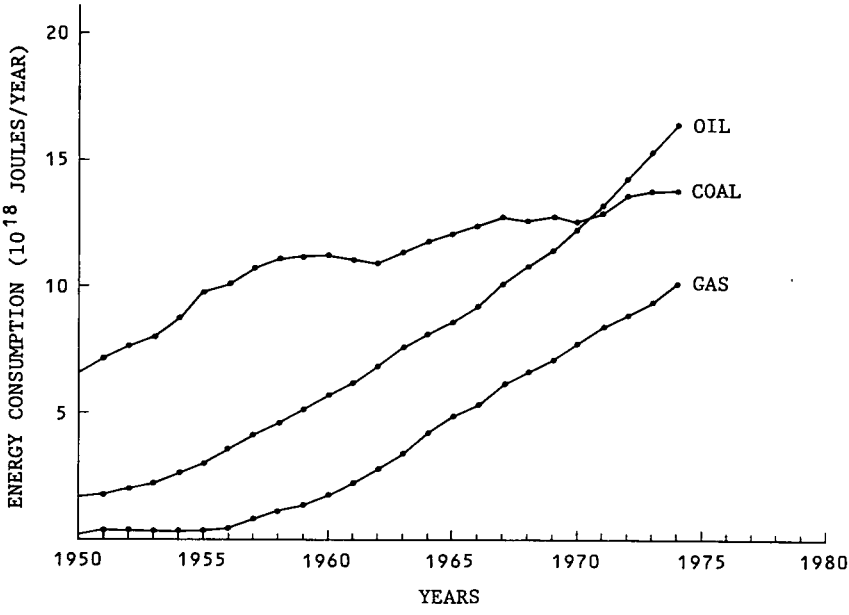

FIGURE 2.—U.S.S.R. energy consumption, 1950–74, from oil, gas, and coal (United Nations, 1976)

Principle No. 1.—The superiority of oil and gas to coal as a fuel.

Figures 1 and 2 show the annual energy consumption for oil, gas, and coal in the United States and the U.S.S.R. In both countries coal was the first to be developed as a fuel, then oil, and then gas. In the United States, oil surpassed coal as an energy source about 1950 and gas surpassed coal as an energy source in about 1966. The U.S.S.R. shows the same pattern developing. There, oil production surpassed coal in about 1970. It appears that natural gas will surpass coal because natural gas consumption has been growing more rapidly than consumption of coal for the 18 years prior to 1975. The replacement of coal by oil and gas has taken place in both countries despite the presence of large coal reserves. In fact, the United States has chosen to import oil at high prices rather than to increase its production of domestic coal. The U.S.S.R. has not replaced domestic oil consumption by coal although that would have allowed it to take advantage of the high prices they could get for exported oil. Economically the two countries followed similar paths except that the United States spends money in order to get oil while the U.S.S.R. foregoes income in order to keep oil. Because oil and gas are superior fuels, the decline in oil production in so many Soviet regions is indicative of an inability to maintain production in those regions rather than a voluntary decision (figure 3).

Principle No. 2.—Most oil is contained in a few large fields although most oil fields are small. This principle will be shown to hold in an individual sedimentary basin, in the United States taken as a whole, and globally.

The distribution of sizes of oil and gas fields discovered between 1921 and 1974 in the Permian basin in west Texas and eastern New

Mexico is shown in figure 4. In that figure, gas has been converted to barrels of oil on an energy equivalent basis. The total number of fields represented is 4,014. Of these fields, 70 contain 100 million BOE (barrels of oil equivalent) or more, and 2,795 contain less than 1 million BOE. Of the oil and gas discovered in the Permian basin, 37.37 billion BOE, the 70 largest fields contain 63 percent and the 2,795 smallest fields contain 1.3 percent. The remaining 1,149 fields, contain 35.7 percent. The dominance of a few large fields has been found in detailed studies of the Denver basin (Colorado), the Gulf of Mexico (Louisiana and Texas), and Kansas. Every well-explored area that we have studied shows this characteristic.

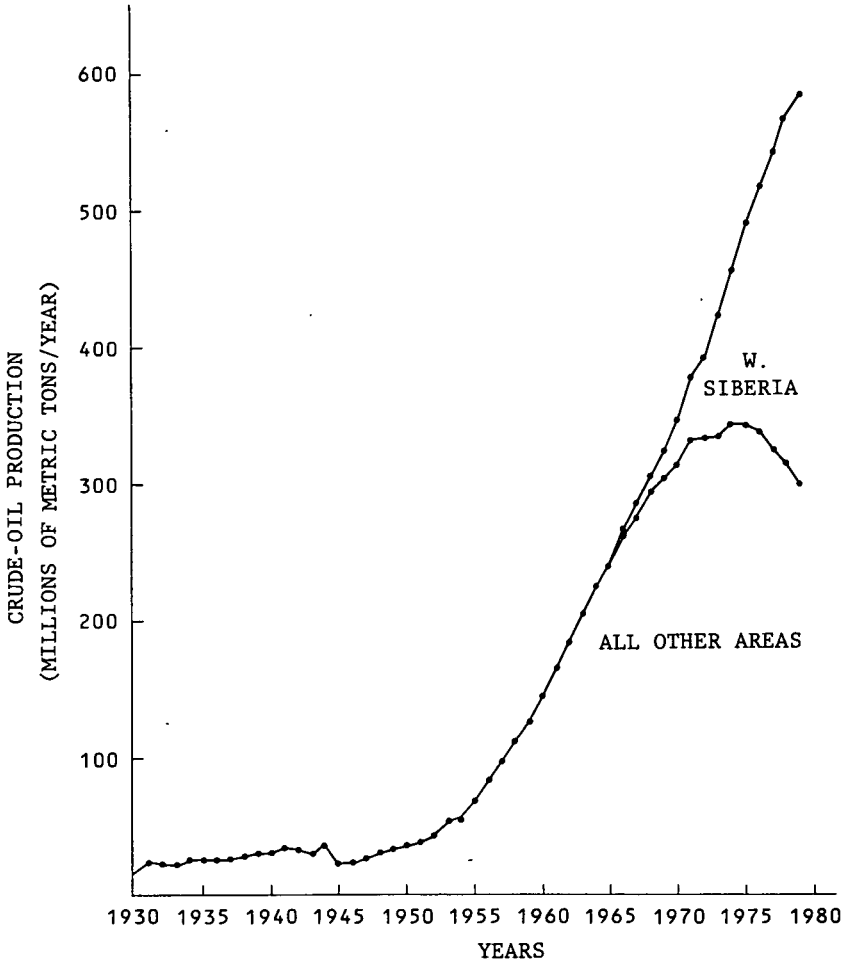

FIGURE 3.—U.S.S.R. crude-oil production, including condensate, 1930–79.

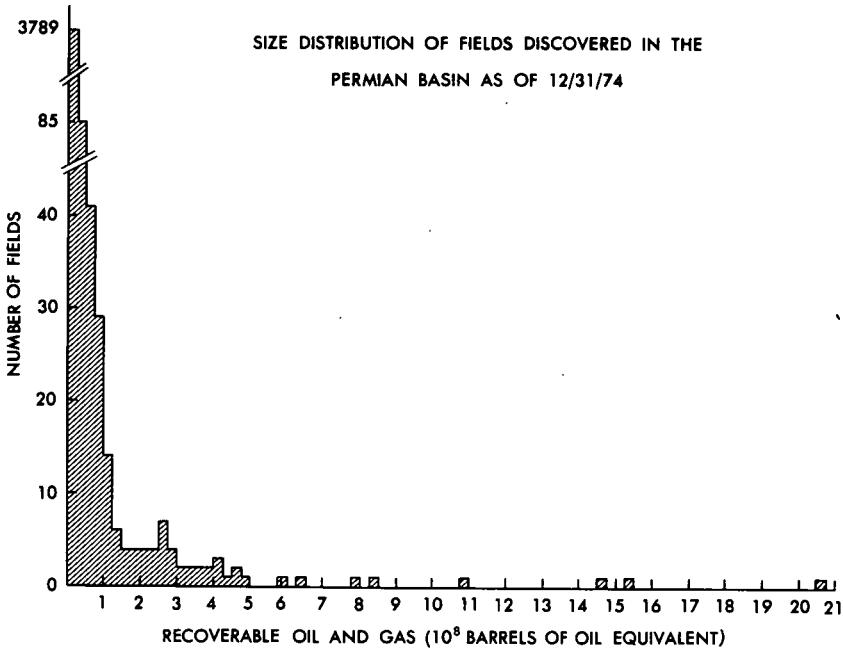

FIGURE 4.—Recoverable oil and gas (100,000,000 barrels of oil equivalent per field (Root and Drew, 1979, fig. 3)

In the United States as a whole, more than 20,000 oil fields had been found by the end of 1979, but only 281 of these fields are believed to have contained 100 million bbl of recoverable crude oil or more.[1] Although the 281 of these fields are less than 1½ percent of U.S. oil fields, they account for ⅔ of all U.S. crude-oil production in 1979, and for ⅔ of all recoverable crude oil discovered in the United States from the beginning of exploration in 1859 through 1979.[2]

According to a compilation of 243 giant oil fields (500,000,000 bbl) of the world,[3] half of all the recoverable crude oil that had been discovered in the world before 1980 was in 33 oil fields. Two of these fields are in the U.S.S.R.; two are in the United States; one each is in Venezuela, China and Libya. The remaining 26 of the world's largest 33 fields are in the states around the Persian Gulf. The estimated total recovery from all 243 giant fields listed by Nehring is estimated to be 763 billion barrels, or about ¾ of all of the recoverable oil that had been discovered before 1980.[4]

Although new oil fields are being discovered every day, most are small. The petroleum industry has achieved its important position as an energy producer by production from a few very large fields, but the discovery of a very large field is rare. This statement is true whether one is discussing a single basin, a nation, or the World.

[1] Oil ad Gas Journal, 1977 and 1980a.
[2] American Petroleum Institute, 1980.
[3] Nehring, 1978.
[4] DeGolyer and MacNaughton, 1979.

Principle No. 3.—In the exploration of a sedimentary basin, the average size of oil and gas fields being found decreases dramatically as exploration progresses, as does the amount of oil and gas found per unit of exploration.

In the Permian basin (western Texas and eastern New Mexico) between 1921 and 1974, 30,340 exploratory wells were drilled. The drilling data, which are published on an annual basis, were divided into 14 consecutive drilling units of approximately 2,000 wells each. The average size of the oil and gas fields found in each of the 14 drilling units, and the number of discoveries for each are shown in figure 5. The average field size declined sharply from 121,000,000 BOE in the first drilling unit to 27,000,000 BOE in the second and 22,000,0000 in the third.[5] In the fourth and fifth drilling units the average discovery sizes were 8,000,000 BOE and 7,000,000 BOE, respectively. Thereafter the average discovery size was never larger than 5,000,000 BOE. The timing of the discoveries of the 70 fields larger than 100,000,000 BOE discloses a pattern that in our opinion holds generally in the development of a petroleum basin. In the first 2,015 exploratory wells, 31 of the 70 large fields were discovered. In the next 4,271 exploratory wells, 24 additional large fields were found. In the last 24,054 exploratory wells only 15 of the 70 large fields were found. The rate of oil and gas discovery per foot of exploratory drilling during 1921–1974 in the Permian basin is shown in figure 6.

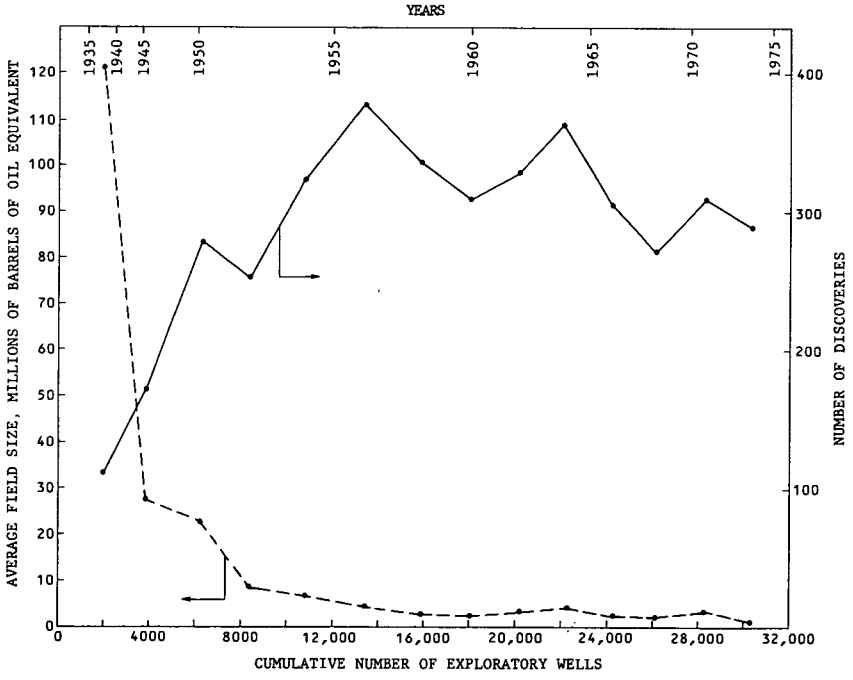

FIGURE 5.—The average field size (1,000,000 barrels of oil equivalent) and the number of fields found in the Permian basin, 1921–74, for 14 successive drilling increments, each of about 2,000 exploratory wells (Root and Drew, 1979, fig. 5)

[5] BOE is barrels of oil equivalent.

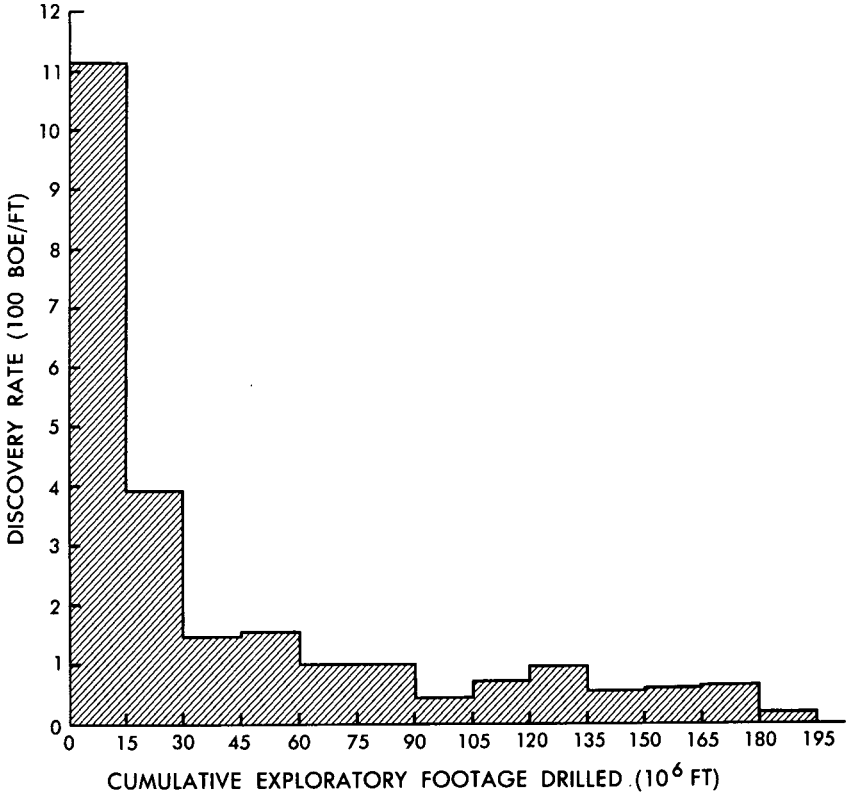

FIGURE 6.—The average discoveries of oil and gas per foot for each 15,000,000 feet of exploratory drilling in the Permian basin, 1921–74. BOE=1 barrel of crude oil or 5,270 cf of wet gas

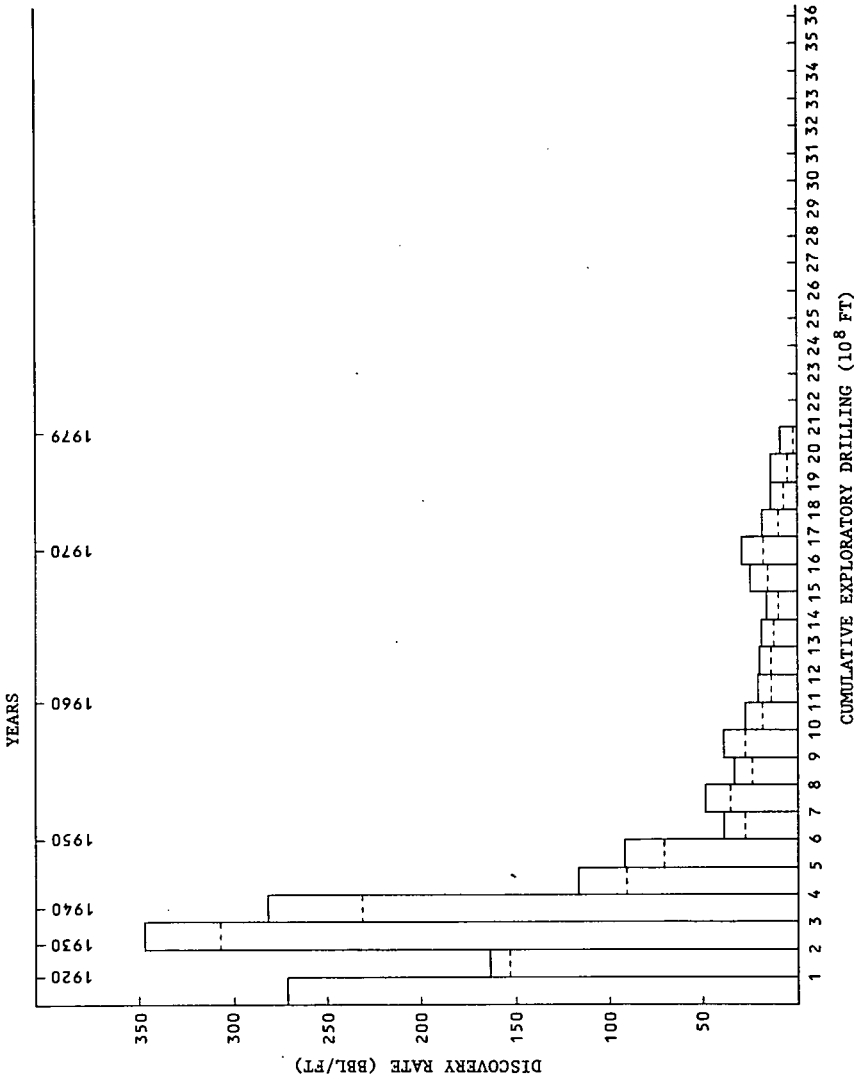

FIGURE 7.—Average discovery of crude oil per foot for each 100,000,000 feet of exploratory drilling in the conterminous United States, 1859–1979. (Updated from Hubbert, 1974, fig. 49)

Figure 7 (updated from Hubbert, 1974) shows the rate of discovery of crude oil in the conterminous United States. It is strikingly similar to the corresponding graph for the Permian basin (fig. 6). Because the technology for exploring for oil has improved since 1945, one can

reasonably suppose that the quality of the prospects left to be drilled in the conterminous United States has deteriorated substantially. This is to be expected from the importance and rarity of large fields. In spite of discovery limitations, however, production continued to rise in the conterminous United States by production from the large fields that had been found before 1950. Eventually the reserves from the older fields were drawn down far enough that production could no longer be increased or even maintained, and in 1970 crude-oil production peaked in the conterminous United States and since then has been declining. From 1970 to 1979 crude-oil production in the conterminous United States declined from 8,890,000 bbl/day to 6,700,000 bbl/day, or 25 percent.[6] The petroleum industries in Venezuela and Canada have followed paths of development similar to that outlined for the conterminous United States.

The U.S.S.R. does not publish detailed statistics on its petroleum industry but enough information is available to indicate that most of their producing regions have already passed their peak production rate and are in decline. The areas in decline are: Urals-Volga, Central Asia, Azerbaijan SSR, North Caucasus, Ukrainian SSR, and Belorussia and Baltic. By analogy with the qualitative model of petroleum development described above, we can assume that those regions in the U.S.S.R. that are in decline will continue to decline, because the production decline in each area was probably brought on by an earlier decline in the discovery rate.

Overall, U.S.S.R. production has continued to increase because of the production from the newly developed West Siberian basin. That basin now accounts for 48 percent of all U.S.S.R. production, i.e., 5,660,000 bbl/day out of a national total of 11,700,000 bbl/day in 1979. If that basin follows the pattern of other large producing regions, both inside and outside the U.S.S.R., then its production will rise to a peak and decline. Because the U.S.S.R.'s producing regions, except for West Siberia and Komi ASSR, are in decline already, the nation can maintain its current production by discovering and developing more new producing areas or by increasing production in the West Siberian basin either from known fields or from new discoveries in the basin. In 1979, Komi ASSR accounted for 3.2 percent of U.S.S.R. oil production after more than 9 years of development which is a slow start if it is to be an important producer. In the West Siberian basin, one field, Samotlor, produced 1,100,000,000 bbl in 1979, an average of 3 million bbl/day (McCaslin, 1980, p. 248). Production at Samotlor began in 1969, and by 1979 it was the second largest producer in the world. Only the Ghawar oil field in Saudi Arabia was producing oil faster than Samotlor in 1979.[7] The rapid development of that field together with the rising and then falling production in older Soviet petroleum districts (fig. 9) are evidence that the Soviet petroleum industry continues to increase production in an area until field depletion forces a decline, rather than developing production to a certain level and then maintaining that level flat for many years. When the decline in production at Samotlor is added to the declines already in progress in other parts of the U.S.S.R., it is very possible that the Soviets will not be able to discover and develop new oil fields fast enough to make up for it, and that national oil production will decline. The timing of the peak

[6] American Petroleum Institute, 1980.
[7] McCaslin, 1980, p. 244.

and decline of production at Samotlor is uncertain from the limited published data, but it could come in any year especially as production in that field is already at such a high level. In general, in petroleum production, stability is the exception rather than the rule both inside and outside the U.S.S.R.

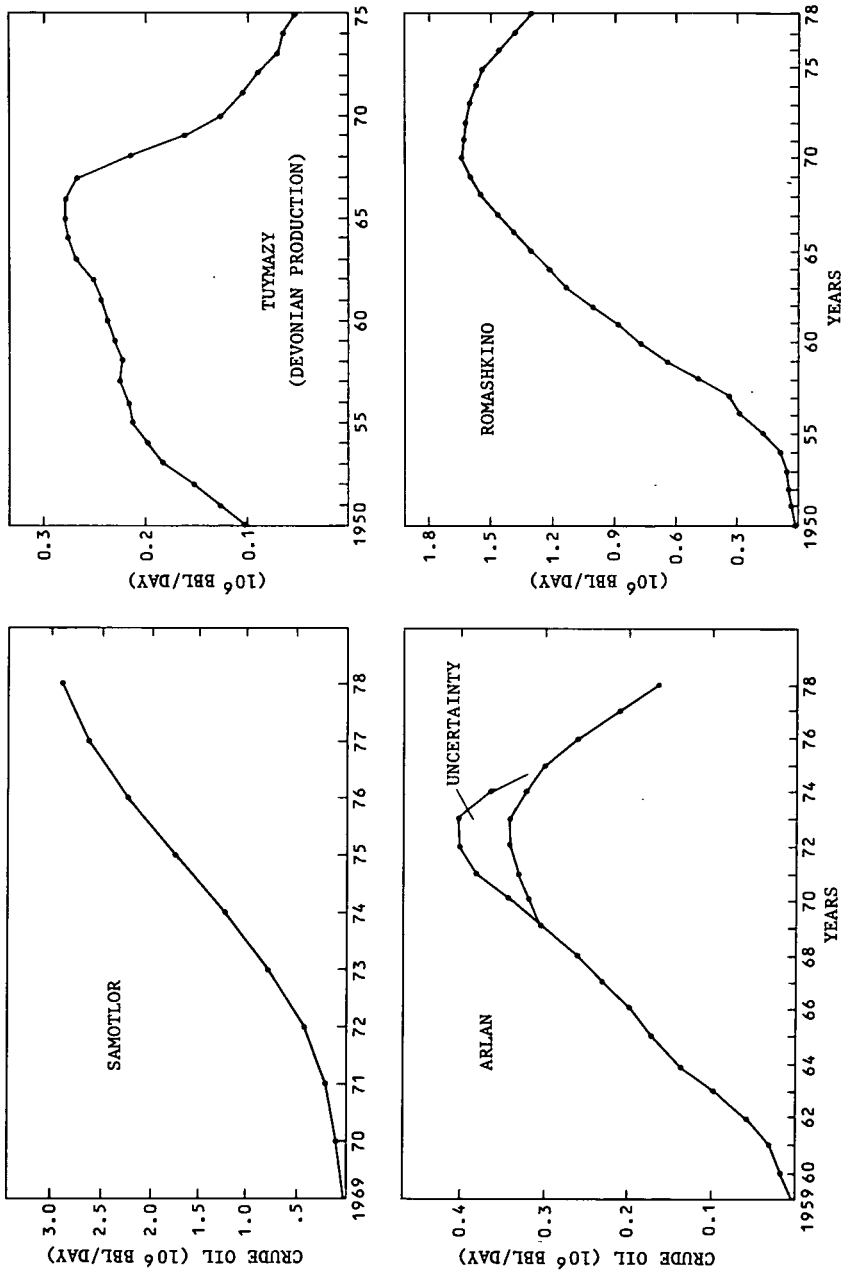

FIGURE 8.—Production histories of four World class giant oil fields (500 million barrels or more recoverable oil)

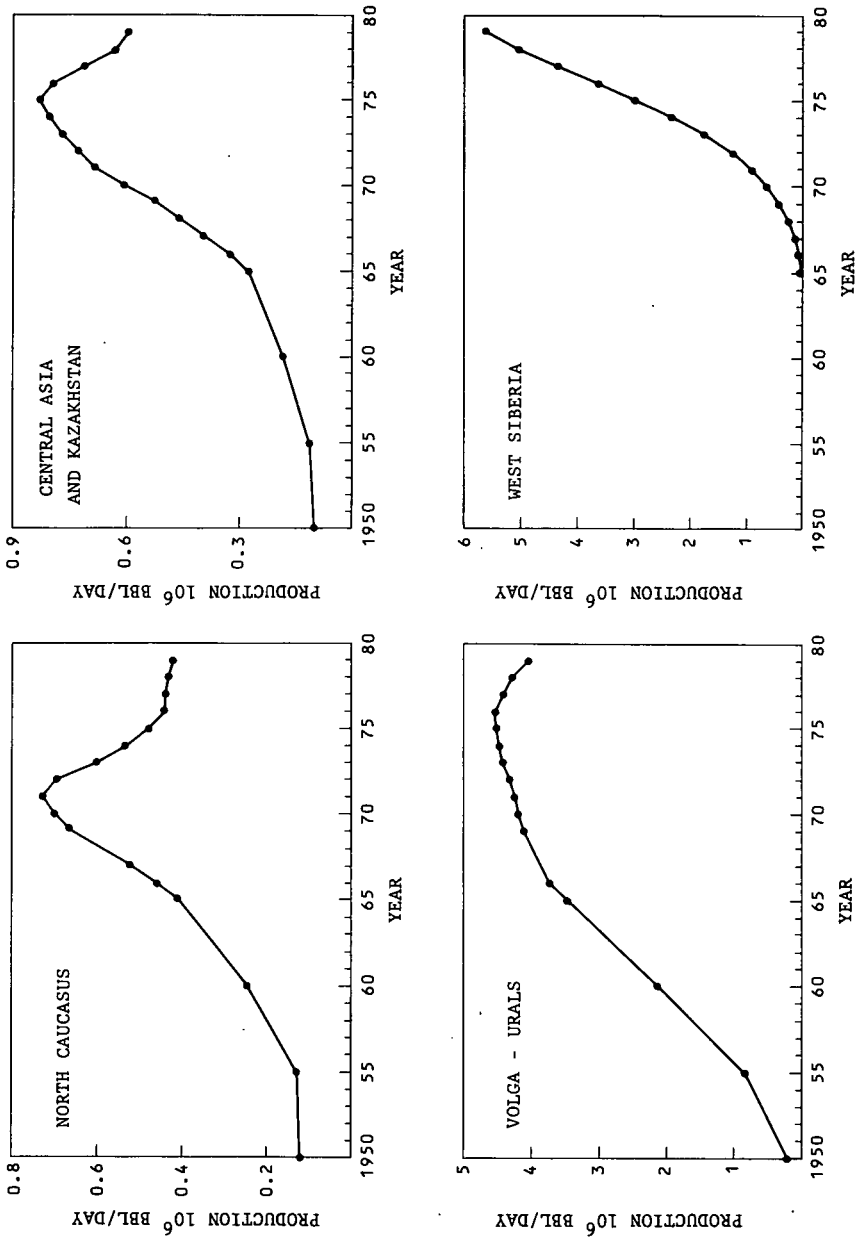

Figure 9.—Production histories of the four most productive regions in the U.S.S.R. During the period 1970–79 these regions accounted for 89 percent of U.S.S.R. crude-oil production

Elsewhere in the world, where we have had enough data to know that a petroleum basin contains most of its recoverable crude oil in a few large fields, those few large fields have been found early in the exploration history of the basin and then the discovery rate fell sharply.

West Siberia will probably follow the same discovery pattern. In fact, the discovery rate in West Siberia has probably already fallen sharply because the oil and gas fields that have been found are distributed throughout a substantial part of the basin, more than 400,000 sq. mi. Depending upon the minimum thickness of sedimentary rock considered, the area of the West Siberian basin is from 735,000 sq. miles [8] to 1,300,000 sq. miles.[9] Surprises are always possible, but as a general rule outside the U.S.S.R. when that much of an area has been at least partly explored the remaining area is far less productive than the partly explored area. If this is true, then the U.S.S.R. will be able to maintain its national 1979 production level only by opening new territority for exploration. Parts of the U.S.S.R., including parts of the West Siberia basin, have not been explored because of hostile environments or distance from the populous areas of the U.S.S.R., for example, the offshore Arctic areas and northeastern Siberia, but even if large discoveries are made in these areas, several years will be required to build pipelines and drill development wells before production can begin.

Possibly U.S.S.R. oil production could decline for a few years and then rise again if large oil fields are found in areas that for technical reasons have not yet been explored. In the United States, frontier areas have often proved to be very productive: offshore Louisiana, offshore California, and northern Alaska, for example. But, it should be remembered that the United States has been disappointed on several occasions when exploration has moved into new areas, for example, Mid-Atlantic coast, eastern Gulf of Mexico, and Cook Inlet.

Indirect signs indicate that the Soviet oil industry is undergoing exploration difficulties and anticipating production problems. Their exploration and production have moved far from their points of consumption requiring long pipelines. They have increased their effort in exploring for offshore fields in the Caspian along a band from Aspheron Peninsula in Azerbaijan to the Cheleken Peninsula in Turkmenia.[10] In comparison, the United States began serious offshore exploration in the Gulf of Mexico in the late 1940's. Figure 7 shows that this coincided with the rapid decline in the onshore discovery rate. Production difficulties are suggested by two newsstories. Pyotr Neporozhny, Electrification Minister, was reported to have said that the U.S.S.R. would open two coal liquefaction plants.[11] Liquifying coal is a more expensive way of getting liquid hydrocarbons than conventional crude-oil production. If good exploration prospects are plentiful then liquifying coal is wasteful; however, if good prospects are scarce or if one anticipates that they soon will be scarce then liquifying coal is sensible. In the second news story the tonnage of U.S.S.R. 1979 oil exports was reported to have declined slightly.[12] The decline, probably less than 225,000 bbl/day, could only be estimated because since 1976 the U.S.S.R. has reported its oil exports in rubles rather than in tons.

[8] Grossling, 1976, p. 55.
[9] Clarke et al., 1977, p. 9.
[10] McCaslin, 1980, p. 202.
[11] Oil and Gas Journal, Newsletter, 1980b.
[12] Oil and Gas Journal, 1980c.

Conclusions

Many regions in the U.S.S.R. have passed their peak years of petroleum production. They have followed a pattern which has become familiar in petroleum producing regions throughout the World, namely production rising to a peak and then declining. Common experience elsewhere has been that such production declines are irreversible. In spite of the production decline in its older regions, the U.S.S.R. has been able to increase its total production by the development of oil fields in West Siberia, principally Samotlor, a field which in 1979 accounted for 25 percent of Soviet oil production. The maintenance of level oil production requires the application of conservationalist policies and such application is not evident in the production histories of the four World class giants in figure 8 or in their four most productive areas shown in figure 9. Soviet efforts at coal liquefaction together with a slight 1979 decline in oil exports are hints that Soviet planners are taking seriously the possibility of a decline in oil production in the near future. Our overall conclusion can be summarized in three parts:

1. The areas of the U.S.S.R., having declining production i.e. Urals-Volga, Central Asia including Kazakhstan, Azerbaijan SSR, North Caucasus. Ukrainian SSR, and Belorussia and Baltic can be expected with considerable confidence to continue to decline and Komi A. R. which increased its production during the 1970's from 150,000 bbl/day to 380,000 bbl/day can be expected to remain a minor producer.

2. With somewhat less confidence we can assert that the discovery rate in West Siberia will be much less than it has been in the past and that sometime in the next 5 years the increases in West Siberian production will be insufficient to offset the decline of production in the other regions producing crude oil in 1980.

3. The future production from the large, as yet unexplored areas of the U.S.S.R., both to the east of West Siberia and offshore Arctic cannot be predicted with data available to us in the public record.

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VIII. SOVIET AND UNITED STATES POLICY OPTIONS

By David E. Gushee and John P. Hardt*

I. Overview

The United States and the Soviet Union are the two major producers of energy in the world that are also major consumers. In production they rank second and first; in consumption, first and second, respectively. To an extent the policies of the two nations have been parallel, in part divergent:

1. Each shifted rapidly in Post World War II years to oil then oil and gas.
2. Each has been affected by the belated realization that domestic supplies of oil and gas are exhaustible and that this fact of limits on hydrocarbon reserves must be taken into account in domestic economic policy.
3. Each is affected by spiralling exploration, production, and transmission costs of primary energy.

However, whereas:

1. The U.S. is a major and likely increasingly significant importer from the foreign sources; the U.S.S.R. is not and is not likely to become a significant factor in the world energy market.
2. The U.S. has undertaken extensive exploration and/or utilization of its probable energy reserves; the U.S.S.R. is still far from geologically explored, especially in Siberian areas and their coastal shelf.
3. The U.S. is a world leader in most forms of energy equipment and systems technology; the U.S.S.R. is less advanced.
4. While the U.S. must increase its imported share of both oil and gas, the U.S.S.R. can export natural gas in increasing amounts for the foreseeable future based on their reserves and likely domestic needs and maintain some exports of petroleum products; CMEA as a whole, however, is likely to be a net oil importer.

Overall each country has reached a threshold point in energy development, each has its "energy debate," each has changed its energy organization to conduct the debate and implement its results. The commonality is the problem of applying short-run solutions to long-run problems when the outcomes are sharply at variance. The difference of approach is one of a guided market vs. a centrally planned economy. Each nation faces an energy supply future of some uncertainty due to natural resource limitations but a range of policy options. Each may continue on the past policy—a status quo approach—and find a serious energy problem escalating into a major crisis in the decade or two

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ahead. Each may adopt a selective, ad hoc policy and wish the best resolutions of uncertainties, i.e. good luck, may be able to avoid serious crisis. Finally, each nation may adopt a comprehensive, integrated, long-term energy policy that would considerably change and resolve energy problems in the economy. However for each the choice of the latter would involve significant short-term costs for long-term benefits and significant, perhaps painful structural changes in the economies. For political decisionmakers with short-term horizons these kinds of present cost for future benefit decisions are particularly difficult.

This is a chapter on the comparative policy issues designed to provide a framework for exploration of differences and similarities in policy. Both major nations—the United States and the Soviet Union—have a stake and a keen interest in their respective policies and performance.[1] Indeed the two giant producing/consuming nations have a considerable impact on global energy policy and performance. As such this discussion paper is not intended to break new research ground or develop policy prescriptions, but to develop a comparative frame of reference.

II. U.S. Energy Policy Issues

A. Historical Highlights

PRE-OPEC PRODUCTION AND PRICING POLICY

Energy import dependence is a new experience for Americans. Inheritors of vast natural resources, their entire economic value system is based on their own peculiar view of the Biblical injunction: "Be fruitful, and multiply, . . . and subdue (the earth). . . ." [2]

Thus, the United States became a voracious consumer of energy, leading (along with Canada which is similarly blessed) the world in per capita energy consumption and leading other developed countries by almost two to one.

For half a century or more, this massive appetite for energy was a good thing, for the U.S. drew on its own resources and on its own vision of the meaning of life to build a mechanized, energy-dependent society. In the process, American leaders identified the role of their natural resources and, by overt policy moves, supported their extractive industries both directly and indirectly to make and keep energy and other industrial raw materials as cheap as possible. Because North America was so abundantly blessed with resources, that policy seemed incontrovertibly reasonable. It was also fruitful, and American enterprise "multiplied and subdued the earth."

Once launched on this course, the United States continued on it during the post-World War II quarter century long after warning signs had arisen that, compared to domestic demand for oil and natural gas, the resource base was not infinite. Discoveries of vast oil deposits elsewhere in the world—primarily the Middle East—coupled with American influence in the world both militarily and economically made the choice to continue on the energy-intensive path via oil imports, an apparently reasonable one.

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[1] Cf. V. A. Nazarevsky, "Ob itogakh energeticheskikh debatov" [Summing up the Energy Debates], *SSHA: Ekonomika, Politika, Ideologiya* (Monthly of the Institute for the Study of the USA and Canada of the Academy of Science), No. 2, 1979, pp. 13–24.

[2] The Bible: Genesis 2:28.

And so it came to pass, along about 1970, that the U.S. appetite for energy outgrew its domestic ability to produce energy, and the country became dependent on oil imports. This dependence increased through 1979, when the U.S. imported some 8.3 million barrels of oil and oil products per day out of a total domestic consumption of about 18.5 million barrels per day—about 45 percent of the total oil consumption, which in turn is about half of all American energy consumption (table 1).

Over the course of the 75 years or so during which the U.S. economy flourished on oil, energy prices declined in real terms almost continuously until 1973 (table 2). These declines resulted from discovery of massive oil and gas deposits in relatively accessible regions, plus the development and application on a large scale of complex technologies for extraction, refining, transportation, and use. The cheapness of the energy and the industrialization of the world have led to construction of a truly vast infrastructure of transportation systems, industries, and residences designed to use this cheap oil and gas.

Also during these same 75 years, other countries, particularly in Western Europe and Japan, have been building their societies on oil (table 3). Their oil, however, has not been indigenous but instead has been imported from other countries. Even imported, its price had been declining over the same period up until 1973.

IMPACT OF OPEC PRICING AND RESPONSES

In 1973, the oil-producing nations, working together as OPEC (Organization of Petroleum Exporting Countries), successfully raised oil prices by a factor of four over only six months. They were greatly aided by the embargo of U.S. and the Netherlands by OAPEC (Organization of Arab Petroleum Exporting Countries), but they succeeded primarily because the industrialized world, including the United States, was heavily dependent on a fuel it could not produce enough of from its own resources and could not, for structural reasons, reduce dependence on in any short time period without unacceptable economic side effects.

In 1978–80, the Iranian revolution and the Iran-Iraq war removed some 5–6 million barrels per day of oil production from the world market while oil prices multiplied again by a factor of about 2.5. The mixture of supply interruptions and price increases has slowed economic growth again in the Western world and added significantly to already-high inflation rates.

Although world trade and the resulting economic interdependence have been viewed as a positive good for generations, these sharp increases in oil price and episodes of supply insecurity have caused industrialized world leaders to separate energy from other goods and debate whether or not economic interdependence was such a good idea, for oil at least. Economists agree [3] that the oil price increase intensified—if it didn't actually cause—a world-wide recession in 1974 and 1975 and contributed between a quarter and a half of the inflation experience over the same period. Economists are working out similar evaluations for the events of 1978–80.

[3] For example, "Higher Oil Prices and the World Economy: The Adjustment Problem," Edward R. Fried and Charles L. Schultze, editors, Brookings Institution, 1975.

In the U.S., oil imports have become so large, and their price so high, that the U.S. balance of payments has turned strongly negative, contributing to increased American inflation rates and deflated values of the U.S. dollar in international currency markets. These economic pressures, coupled with the sharp sensitivity to how vulnerable the country has become to the actions of others not necessarily so friendly, have contributed their dimensions to the American policy debate over the merits of oil import dependence and its corollary-economic interdependence.

Another of these dimensions is the issue of national security and the desire for independence of action. This dimension was high in priority in 1973–74, when President Nixon initiated "Project Independence," a program designed to reduce oil imports to strategically negligible amounts as rapidly as possible (proposed initially to be seven years) and high again in 1979 when President Carter proposed a major synthetic fuels program and streamlining of environmental regulatory procedures.

The third major dimension is a reaction to the implicit American ethic that the Lord meant for His people to "subdue the earth," which in the U.S. has come to mean using up everything as fast as possible. Reaction to "energy gluttony"—to use a popular code word—has set in. This reaction, which has its counterpart in other Western countries as well, has many faces, including the antinuclear movement, the environmental movement, the "small is beautiful" movement, and ultimately, the "no further growth" movement. In a historic context, it is not new, having surfaced for over a century in the U.S. as the conservation movement, with its interests in protection of forests, grasslands, and other natural heritages.

For the past seven years, the American energy policy debate has been a clash among these differing perceptions of the energy situation. Arguments and protests swirl about the propositions that:

Cheapest is best, no matter where it comes from.

Energy independence is best, no matter how much it costs.

Growth—and thus resource utilization—is unsustainable over the long-term and so must be slowed, if not stopped.

This debate has been characterized by confusion among its participants about the facts. Proponents of the several perceptions state as facts a number of estimates, guesses, and at times even value judgments which support their views. This lack of agreement on the facts has added to the confusion attending the debate and has, at times, obscured the fact that the basic debate is one of clashing values. Nonetheless, out of the melange of confusion and clashing interests, the United States has made a number of policy changes and has—sometimes consciously and sometimes unconsciously—decided to not decide about other issues.

The primary decision made by the U.S. has been to increase the role of its Federal Government in the energy sector. Energy is on the agenda of dozens of Congressional committees and subcommittees. A Department of Energy has been created. Into it have been put activities ranging from oil and gas price regulation through alternative energy technology development to fuel production, utilization, and storage decisions. It has major planning responsibilities. And it

has a strong voice in national economic and security policy-making processes.

The Department of Energy has been given authority by the U.S. Congress to set energy efficiency standards for a wide range of domestic appliances, to develop energy-conserving technologies for use by individuals and industries, to force the conversion of industrial and utility boilers from oil or gas to coal or other indigenous fuels. It has been given major transfusions of money to develop technologies for converting solar energy to heat or electricity, coal to oil or gas, waste products to useful energy. It has a voice in local regulation of electricity prices.

A Synthetic Fuels Corporation has been set up as a mixed government/private operation, funded by part of the income from a new tax on domestic oil production. In addition, a number of contingency programs have been created—a Strategic Petroleum Reserve, an emergency rationing program, and a range of allocation and emergency conservation authorities.

These increases in the Government's role in energy decisions are real. But they are not unconstrained. In recognition of the many facets of the energy situation, the Congress has rather severely limited the power of its new Department of Energy to act unilaterally. Every decision on oil or gas price is either subject to comprehensive Congressional review (oil) or rather precisely dictated by the authorizing law (gas). Decisions to require conversion to coal are challengeable on economic or environmental grounds. New technologies can be developed, but no one is forced to use them.

Before the emergency rationing program can be activated, the Congress must be notified and can block implementation. Even the semi-independent Synthetic Fuels Corporation was limited in its early years to only enough money to support construction of one plant each of less than a dozen alternative supply technologies and must return to Congress for additional funds to go further. And President Carter's proposal to streamline the environmental regulatory process—the Energy Mobilization Board—failed to pass the Congress.

Constraints on the Department of Energy's freedom of action are not the result of whim. Rather, they are in recognition of the fact that the three major perceptions of the energy situation cited earlier—economy, security, and life style—are mutually incompatible. To gain one, the Nation must sacrifice some aspect of at least one other. There is no clear indication that such a sacrifice must be made, nor is there any clear signal that any one perception should predominate over the others.

For while the U.S. Government has debated, the U.S. economy has been adapting to the higher energy price resulting from OPEC actions in 1973 and 1979–80. Electricity demand growth for example, has declined from about twice the rate of GNP growth to about 1.5 times GNP growth rates, even while GNP growth rate itself has declined. Gasoline consumption rose from 1973 to 1979 at about 3 percent per year in contrast to the earlier rate of about twice that and has fallen about 6 percent in 1980 relative to 1979. Petroleum demand itself, which had been rising at some 5–6 percent per year in the 1960's rose only 1.4 percent in 1978, a year of overall economic growth com-

parable to those in the 1960's, fell about 1.8 percent in 1979 and has fallen an additional 8.4 percent through the first two-thirds of 1980.

New U.S. autos now average over 20 miles per gallon, compared to about 13 miles per gallon in 1974—the lowest ever. Autos will improve each year through 1985 to an average of 27.5 miles per gallon. This improvement was required by legislation passed in 1975, but there are many signs that fuel economy improvements will surpass that goal on the basis of economics and jitters from possible further supply interruptions, rather than from the legislation.

Energy consumption in U.S. industry actually declined for several years, and energy consumption per unit of output has declined markedly since 1973.

In sum, overall energy consumption, which for some 25 years had risen almost equally with GNP rise, rose in 1978 only 2.2 percent for a GNP growth rate of about 4.4 and in 1979 rose only 1 percent for a GNP rise of about 2.3 percent. There is no indication that the improvements in unit energy consumption have peaked out. Instead, new construction in cars, houses, and industrial processes shows every evidence that the U.S. system has not yet completed its adaptation to the current energy prices.

REVISED ENERGY SUPPLY AND COST PROJECTIONS

Technicians do not agree on how much further the American (and Western European and Japanese) economies can go with respect to conservation, even when assuming relatively constant future energy prices. Technicians do not agree on the future health of the world's economy. They do not agree on how much additional crude oil productive capacity either can be or will be put into place over the next decade, the duration of the Iran/Iraq war, the future role of oil from Iran, or the possible entry of the Soviet Union into the world oil market as a buyer. These issues include both technical questions with respect to resources and political questions with respect to perceptions of national interest held by the several oil producing countries.

The consequences of these uncertainties is a gross uncertainty over future energy supply security and supply/demand balances and hence energy prices. This gross uncertainty is now the backdrop for current debate in the U.S. over its next phase of energy policy decisions.

The U.S. is moving in the direction of higher energy prices, slower economic growth, increased use of alternative domestic fuels, and reduced import dependence. However, its policy is still flexible enough to provide room for future decisions to redirect the U.S. along paths varying all the way from removal of fuel price controls to more-stringent price controls, from no growth to heavily-stimulated growth, and from continually-reduced oil imports to continually-increasing imports. The most probable path, naturally, would be somewhere in between and could be described as a "selective ad hoc" policy rather than as a comprehensive and unequivocal policy aimed at any single set of economic growth or minimized oil imports objectives.

B. Agenda of Issues

On the American policy agenda now, at the beginning of the 97th Congress, are the following major issues:

1. OIL PRICES

Oil prices are currently controlled in the U.S. under the Energy Policy and Conservation Act as amended. Under this law, price controls, which were mandatory through May 1979, have become discretionary and determined by decision of the President. At the summit meeting with European leaders in July 1978 President Carter committed the U.S. to raise U.S. energy prices to the world level by the end of 1980.

In his April 1979 decision, the President determined that U.S. upper-tier crude oil prices would rise from January in a straight line from the then-current controlled levels to September 1981, at which time they would reach the world oil price as of April 1979. At the same time, oil produced from U.S. wells, starting in June 1979, would be shifted gradually from categorization as "lower-tier oil" or "upper-tier oil" to "upper-tier oil" and "new oil" respectively. The net effect of this process has been to shift more and more oil from "lower-tier" to "upper-tier" while at the same time moving the "upper-tier" price closer and closer to the world price. The Windfall Profit Tax Act of 1979 divides the increased revenues from oil production between the oil producers and the U.S. Treasury.

On October 1, 1981, all U.S. oil price control authority will terminate. On January 28, 1981, President Reagan administratively decontrolled oil prices. All U.S.-produced oil then, absent new Congressional action, sought the level of world oil prices in effect at that time.

Given the comprehensive policy option of minimizing oil imports, Congress need take no special action. However, given a selective ad hoc policy, Congress could decide to continue price controls in order to favor economic levels, if it deemed the economic situation to require continued control of oil prices below world levels. The Congress has as yet taken no special action in response, although proposals for continued special protection for smaller refiners are being discussed.

2. NATURAL GAS

The natural gas pricing policy issue was thought to be settled by Congressional passage in late 1978 of the Natural Gas Policy Act as part of the President's National Energy Plan. Under this Act, new natural gas well-head price was set to rise at a controlled rate through 1985, when it is scheduled for deregulation. Industrial users of natural gas will pay higher rolled-in prices until theirs reach the oil equivalency level, at which point residential and other protected users will get their prices increased (incremental pricing).

Incremental pricing has proven to be more difficult to administer and less desirable economically than had been thought when it was created. Further, the sharp rise in oil price since 1978 has increased the gap between oil and gas prices despite the programmed gas price increases. The resulting distortions in markets and price make it likely that Congress will reconsider these provisions in 1981, along with some of the gas prohibition provisions of the Powerplant and Industrial Fuel Use Act of 1978 (PIFUA). Under a comprehensive

oil import minimization policy, gas prices would be decontrolled, incremental pricing would be done away with, and industrial gas use restrictions would be lifted. Under a selective ad hoc policy option, gas prices might continue to be controlled for economic or social purposes while incremental pricing and fuel use restrictions might be lifted to encourage industrial switching from imported oil to domestic gas.

3. COAL

Coal is the great under-used fuel resource in the U.S., if one goes by the conventional wisdom which says "that resources are vast and accessible, technology is available, economics are promising, and policy seeks to increase its use." The Powerplant and Industrial Fuel Use Act (PIFUA), also enacted in October 1978 as part of President Carter's Energy Plan, requires that all major new fuel burning facilities in industry and utilities burn coal or other alternate fuel and seeks to force early retirement of existing facilities unable to burn coal in favor of new, coal-burning ones. Regulations to implement PIFUA are still being developed and are meeting with strong resistance based on the physical, environmental, and economic difficulties associated with coal use and the complexity of the regulatory procedure.

A reasonable bet is that, under the selective ad hoc policy option, coal would be used where economic, it would not be used where clearly not economic (despite PIFUA), and facilities in the gray area in between would be built on oil or gas use or possibly on dual or multiple fuel capability. Environmental restrictions would be maintained or conceivably eased slightly. Under the comprehensive oil import-minimization policy, however, DOE interpretation of PIFUA rules would be so tough as to cause facilities in the gray area either to burn coal, not to be built at all, to be built outside the U.S., or to be built on gas use after FUA amendment, while environmental requirements would be greatly softened.

Coal is also promoted by Department of Energy and many others as a source for synthetic fuels, either gaseous or liquid. DOE has major development programs for coal conversion technologies and had funds for research, development, and demonstration programs in a number of alternative technological approaches. President Reagan has proposed termination of all the development and demonstration programs as part of his cost-reduction program, leaving all such activities, other than those to be underwritten by the Synthetic Fuels Corporation, to the private sector. The Synthetic Fuels Corporation will help underwrite the costs of up to 500,000 barrels of oil equivalent per day, most of it from coal.

The issue in commercialization of synfuels from coal is economic. There is agreement that demonstration and commercialization of synfuels must be underwritten by the Government to get them started; there is disagreement on whether, once started, they would become economically self-sustaining. The prevailing industrial judgment is that they would not, either at current oil prices or under any probable oil price scenario. Thus, the policy question is whether to commit the country to a course of action which would probably be economically counterproductive in terms of either fuel price, inflation, or Federal budget deficits, for the purpose of improving the future possibilities of reduced oil import dependence. Under the ad hoc selective policy

option, the outlook for synfuels in the near term would be close to the provisions of the first phase of the commercialization program laid out in the Energy Security Act of 1980. Under the oil import minimization option, synfuels demonstration plants would be fully funded and commercialization would continue to proceed as rapidly as procedural hurdles could be overcome.

4. NUCLEAR

The U.S. nuclear manufacturing industry is struggling to survive. Antinuclear sentiment has made U.S. utilities very wary of new commitments to nuclear power. President Carter gave little encouragement to use of uranium as a fuel. The U.S. Congress has not been prepared to commit the nation to greater use of nuclear in the face of this antinuclear sentiment and the concern over possible spread or proliferation of nuclear weapons from wider world use of nuclear power. It is important to recognize, though, that the U.S. has not needed over the past several years and does not need new nuclear commitments over the next couple years because of reduced growth in electricity demand, while the ill-health of the nuclear industry is not yet critical.

Nonetheless, President Reagan supports nuclear power as an important energy source and is expected to support moves toward its greater use to reduce oil imports. Under a selective ad hoc policy, support of increased use of nuclear power would include retention of all current procedural requirements, regardless of their impact on construction schedules. Under an oil import minimization policy, bypassing some procedural steps, such as public participation, would accelerate construction.

5. NORTH AMERICAN FUEL OPTIONS

Recent announcements by Mexican authorities that their country's oil and gas reserves are very large have led to new pressures in the U.S. to strike economic bargains with Mexico to gain access to the oil and gas. The advantages to the U.S. of such access are obvious. On the other side, however, are such factors as the price, the willingness of Mexico to export, the impact on the proposed gas pipeline from Alaska, and the impact on price and volume of gas imported from Canada.

Under an oil import minimization policy (with the area of greatest concern the Mid-East), one would expect that negotiations with Mexico and Canada would proceed aggressively while the Alaska gas pipeline project would be given full governmental support, including, if necessary, Federal underwriting of some part of construction financing.

6. CONSERVATION IN THE U.S. ECONOMY

The conservation potential of the U.S. economy is the subject of considerable discussion, in that the economic "flexibility" of the economy under current conditions is beyond the range of previous economic experience and is not predictable. Thus, one conservation issue is: Should the U.S. wait to see how much energy is conserved by price: if not, should more mandatory conservation requirements be imposed or should additional financial incentives be made available?

Again, a selective ad hoc policy would be anywhere from passive to modestly positive toward conservation. An oil import minimization policy would include strong tax and other financial incentives plus some mandatory conservation requirements.

7. ENERGY POLICY AFTER 1980

Election of Ronald Reagan and a Republican Senate, coupled with a more conservative though still Democratic House, will impact heavily on the ideology of U.S. energy policy. Whether the new political structure will also mean a shift in the structure of energy policy from "selective ad hoc" to "comprehensive oil import minimization" or any other "comprehensive" remains to be seen.

Clearly, energy price controls and energy regulations will be de-emphasized wherever possible (in light of the Democratic House, this might not be possible in many cases where legislation is required). Since oil price controls have been ended, the increased incentives for oil production favor oil import reduction.

The Republican ideology also favors less regulation and more market incentives in general. This would indicate that current incentive programs for installation of insulation, etc. in the residential sector, gasohol, solar and wind, and other alternative energy sources would continue. Regulations such as in auto fuel economy standards, fuel use in utilities and industry, and appliance efficiency standards would be de-emphasized.

So the role of the Government would continue but shift from regulatory policy to fiscal and tax policy. Emergency programs would still be required, as would research and development and support work associated with putting new technologies into the market.

In other words, aside from price controls and other regulations, the main theme of U.S. energy policy—orchestrating the country's course among the mix of economic, social, and oil import goals—will continue to be selective ad hoc, with different hands on different levers, with different economic and social impacts but little change in most major fuel supply and use patterns and trends. For, as a recent Department of Energy study pointed out, it is difficult, if not impossible, to identify and measure the impacts of all the Federal energy programs created and operated to date, because their effects are small compared to the impacts of the existing energy supply and use infrastructures and the impacts of energy price changes.

Were the programs able to be effective enough to measure their impact, their driving forces would have been so great as to have resulted from supremacy of oil import minimization goals over other goals, a supremacy that it has not been able to achieve in the face of periodic oil surpluses and the costs of other ways of doing energy things.

Unless the world oil supply situation becomes even grimmer than it is now, or some technological breakthrough occurs, the U.S. will undoubtedly continue its selective ad hoc policy regardless of its political leadership. The biggest difference that changes in leadership will bring is in the prevailing judgment as to what mix of regulations (the stick) and incentives (the carrot) to apply at the margins of economic activity and personal behavior.

TABLE 1.—U.S. ENERGY MIX

[In quadrillion Btu]

	Domestic production			Imported oil		Total energy consumption
	Oil	Gas (dry)	Coal	Crude	Product	
1950	13.3	6.0	12.9	1.0	0.8	33.6
1955	17.3	9.0	11.5	1.7	1.0	39.2
1960	19.9	12.4	10.1	2.2	1.8	44.1
1965	23.3	15.8	11.9	2.6	2.7	53.0
1968	27.0	19.2	12.7	2.7	3.4	61.3
1969	28.3	20.1	12.7	3.0	3.9	64.5
1971	30.6	22.5	12.0	3.7	4.9	68.3
1972	33.0	22.7	12.5	4.7	5.5	71.6
1973	34.8	22.5	13.3	6.9	6.6	74.6
1974	33.4	21.7	12.9	7.4	5.8	72.8
1975	32.7	20.0	12.8	8.7	4.3	70.7
1976	35.1	20.1	13.7	11.2	4.5	74.5
1977	37.2	19.9	14.0	14.0	4.8	76.4
1978	38.0	20.0	13.9	13.5	4.4	78.2
1979	37.0	19.9	15.1	13.5	4.1	78.0

Source: Annual Report to Congress, 1979. vol. II

TABLE 2.—U.S. OIL PRICES

[Average price of crude petroleum per barrel in nominal dollars]

	Domestic	Imported (Saudi)
1900	NA	NA
1910	NA	NA
1920	3.07	[1] NA
1930	1.19	NA
1940	1.02	NA
1950	2.51	1.75
1960	2.88	1.80
1970	3.18	1.80
1971	3.39	2.29
1972	3.39	2.48
1973	3.89	5.04
1974	7.18	12.52
1975	8.39	13.93
1976	8.84	13.48
1977	9.55	14.53
1978	10.50	14.50
1979	[1] 14.27	[1] 21.67
1980 (7 mo)	[1] 22.60	[1] 33.26

[1] DOE Monthly Energy Review, October 1980.

Source: 20th Century Petroleum Statistics, p. 41. DOE, Monthly Energy Review and Senator Bellmon's. Refineries acquisition costs speech, Feb. 8 1979, Congressional Record, p. 5136.

TABLE 3.—FUEL MIX, SELECTED COUNTRIES

[In percent]

	Western Europe		Japan	
	Coal	Oil	Coal	Oi
1925	96	3	92	4
1938	91	8	84	11
1950	84	13	83	6
1955	76	21	68	22
1960	58	29	53	30
1965	43	45	34	50
1970	29	62	22	62
1974	22	60	19	72
1980	[1] 17	[1] 55	[1] 12	[1] 74

[1] Exxon's World Energy Outlook.

Sources: Energy in the World Economy, by Joel Darmstadter, Johns Hopkins Press, 1971. Energy Balances of OECD Countries 1960–1974, Organization for Economic Cooperation and Development, 1976.

III. Soviet Energy Policy Issues[4]

A. Historical Highlights

PRE-OPEC PRODUCTION AND PRICING POLICY

For many years, especially during the rule of Joseph Stalin, the Soviet energy policy was dominated by coal. To be sure, hydroelectric stations such as the Volkov Station during the pre-industrialization energy plan [Goelro], the Dnieper station in the First Five-Year Plan and the Volga river stations in the 1950's were much publicized, but the primary share of the Soviet energy balance was coal. Coal was for electrification for railroad transport, for metallurgy and for commercial needs. Coal was the bread (khleb) of early Soviet industrialization.

Of course, other industrial countries emphasized coal use, but not as much or as late in time as the Soviet Union. Oil had taken over much of the major energy role in transport and electric power in North America and Europe when the Soviet Union began in the Seven-Year Plan (1959–65) its major shift to hydrocarbons. When the shift came in the Soviet Union, it was pursued with considerable vigor. The rail system, for example, converted from steam and coal to diesel and hydro-electric drive in the course of that Seven-Year period. At the time it appeared that Soviet petroleum reserves were inexhaustible. The then new Ural-Volga giant fields were expected to grow in production up into the 1970's. As the major Ural-Volga fields began to peak out earlier than expected there was some concern about energy constraints. In 1967 at the CMEA meeting restrictions were discussed on oil deliveries to the East European members from the USSR. Then the monster, new fields of West Siberia such a Samotlar were brought into production. As these giant oil fields and other deposits could also produce natural gas in seemingly limitless amounts, the new production eased the sense of energy problems in early 1970. With this hydrocarbon cornucopia, the expanding Soviet domestic needs and those of East European CMEA countries could easily be met, it appeared. Likewise, petroleum and petroleum products would become a major source of convertible, hard currency earnings for increasing trade with the Western industrial countries.

CMEA countries were encouraged by low Soviet oil prices and a similarly optimistic views of oil and gas reserves in the U.S.S.R. to rapidly expand hydrocarbon use. Coal and other East European energy sources became less important as energy sources in the energy balances of the smaller East European countries. Pricing of energy on stable five-year plan prices, correlating with the then low OPEC prices encouraged this process of shift from coal. From 1960 to 1973 there had been a significant increase in CMEA reliance on Soviet oil

[4] For reference, see ECE. *New Issues Affecting the Energy Economy of the ECE Region in the Medium and Long Term*, with addenda, dated 10 Jan., 18 Jan., 6 Feb. and 9 Feb. 1978; ECE. *Energy Problems and Cooperation in the ECE region* for third session of Senior Advisors 16 to 20 Feb. 1981, 15 Dec. 1980; Marshall Goldman *The Enigma of Soviet Petroleum, Half-Full or Half-Empty*. London: George Allen and Unwin; David Wilson. *Soviet Oil and Gas to 1990*, London: Economic Intelligence Unit, Ltd. Nov. 1980: Petrostudies, Soviet Proved Oil Reserves, 1946–1980; Centre De"Etudes Prospectives Et D'Informations Internationales (C.E.P.I.I.) *La Politique Petroliere Sovietique Dans Le Monde*, Paris, October 1980. "Soviet Oil and Gas in the Global Perspective" by John P. Hardt, Ronda A. Bresnick and David Levine in *Project Interdependence: U.S. and World Energy Outlook through 1990*. Senate Committees on Energy and Commerce Committee, Nov. 1977.

imports, although it was uneven from country to country, with Poland sticking with coal and Romania with their own oil.

Likewise expanding Western trade had been lubricated by what in the West from the 1960s was described as the "Soviet oil offensive." The Soviet Oil Minister Shashin was viewed in the West as an oil salesman who might undercut the low Western/OPEC oil prices by "dumping" even cheaper oil on the world market. With this attractive and seemingly unlimited sources of hard currency from petroleum exports, less attention by Soviet planners may have been given to developing other hard currency exports, especially industrial goods.

By the time of the OPEC price rise in 1973 one might suggest that there had been a strengthening of CMEA reliance on the assumption that cheap Soviet oil supplies could be found to meet expanding domestic CMEA and foreign trade needs. Moreover, it may have seemed that the oil reserves would be supplemented by equally inexhaustible natural gas supplies and potential gas production and exports. Of course, the Soviet gas deposits were in distant Siberia—technically difficult and economically costly to exploit. However, there was reason to believe in 1972–73 that the monster gas deposits in Siberia—the "North Star" and Yakutia fields—would be jointly developed by Soviet-American efforts. Indeed these two gas projects were projected by the Nixon Administration as the centerpieces of economic detente.[5]

IMPACT OF OPEC PRICING AND RESPONSES

The quadrupling of world petroleum prices following the Arab embargo of 1977 might well have seemed a bonanza to Sovet economic planners, if the earlier assumptions of ample oil reserves and Western energy development cooperation had held. Indeed the OPEC price rise apparently resulted in a foreign trade hard currency windfall in 1973–74 as the Western price paid for Soviet petroleum and petroleum products skyrocketed.

However, the Soviet oil reserve assumptions began to come under more serious doubt. Oil output in the Ural-Volga field had peaked earlier than anticipated and the emphasis had to be placed earlier than planned on the expansion of output from the West Siberian fields. That would have been all right if other monster fields could have been proven out and put in line for exploitation to take over for the West Siberian fields when they, in turn, peaked. However, no new monster fields have been located.

The more rapid development of the large-scale Siberian natural gas fields, in turn, would be less of a burden on the current Soviet plans and technological resources if developed with substantial external Western financing and large-scale industrial cooperation and technology transfer from the West. Use of more advanced Western technology, especially in transmission, would have been more efficient and less of a domestic burden. Financing which involved both deferred payment and compensation in kind, that is, deliveries of future natural

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[5] See Jonathan P. Stern. *Soviet Natural Gas to 1990: Options and Priorities for Soviet Energy Policy and Strategic Implications for the West. Op. cit.* For useful Western sources on Soviet energy, also see: Robert W. Campbell. *Trends in the Soviet Oil and Gas Industry.* Johns Hopkins University Press, 1976: Leslie Dienes and Theodore Shabad. *The Soviet Energy System.* V. H. Winston and Sons, 1979: Jeremy Russell. *Energy as a Factor in Soviet Foreign Policy,* Levington: Saxon House, 1976: *CIA. Prospects for Soviet Oil Production: A Supplemental Analysis, 1977.* See Brendow, Bogomoloy, Balkay, Dohozi, Bethenhagen, Brandstetter in *East and West in the Energy Squeeze, Prospects for Cooperation.* C. Saunders (editor), *op. cit.*

gas output, would have greatly accelerated the effective development and utilization of this energy resource. However, Soviet-U.S. negotiations concerning joint energy exploitation have been neither rapid nor thus far particularly successful.

Adverse economic developments elsewhere leavened the benefits to Soviet balance of payments from the OPEC oil price rises. The Western stagflation had an adverse effect on the Soviet hard currency balances. The prices paid for imported industrial goods increased—probably inflated much more than Soviet planners had anticipated—and the market for non-oil exports was cut by the recession in the West. With adverse development on both sides of the Soviet hard currency balance of payments, resulting from rising import costs and restrictive export markets, the gap apparently had to be filled by increased oil exports and expanded hard currency debt.

The expanded hard currency debt also had its good and bad features. On the one hand, the Western recession made loanable funds available in the Eurodollar market and elsewhere. However, the terms were not as attractive as might have been expected due to a limit on certain Western government credits. The withdrawal of U.S. Export-Import Bank facilities and agricultural credits was one negative aspect of the government part of the Western credit market. Likewise, some of the other Western government credit conditions, especially from Japan and the FRG, were not as attractive in terms of length of payment and other aspects of repayment conditions as might have been expected by the USSR.

So the silver cloud of the OPEC price rises had a dark lining for the Soviet Union; anticipated oil and gas supplies were less, requirements for increased earnings from hydrocarbon exports were greater. Likewise, the adverse impact of the restricted hydrocarbon supplies and Western stagflation was also felt on the smaller East European CMEA countries and reflected back on the Soviet Union.[6]

The East European countries were then asked by the Soviet Union to pay more for their energy imported from the U.S.S.R. The CMEA price increases, although substantial to the East European countries, still left intra-CMEA prices below the OPEC price levels. This action lead to a severe new burden to the East European economies and a perception of an imputed subsidy or sacrifice of hard currency income to the Soviet Union. With a new sense of limited future supplies, the projected Soviet deliveries of oil and gas to Eastern Europe for the future were doubtless scaled down. Oil imports from the hard currency demanding OPEC countries, therefore, had to be sought by the East European countries. From the Soviet side the East European countries appeared more cooperative on joint projects, such as the Orenburg gas pipeline, but less able to balance their trade with the U.S.S.R. especially with hard good exports. Economic crises and potential instability in East Europe apparently contributed to a Soviet willingess to accept balance of payment deficits with many of the East European countries and even extend hard currency loans. The latter, of course, aggravated the Soviets' overall hard currency

[6] John Hannigan and Carl McMillan, "Joint Investment in Resource Development" Ron Oeshler and Jack Martens "East European Trade With OPEC: A Solution to Emerging Energy Problems?"; Jack Kramer, "The Policy Dilemmas of East Europe's Energy Gap"; Jan Vanous, "East European and Soviet Fuel Trade"; Robin Watson, "The Linkage Between Energy and Growth Prospects in East Europe," all in *East European Economic Assessment: Part 2, Regional Assessments*, Joint Economic Committee, U.S. Congress, April 1981.

problems. Encouragement, indeed enforcement, of energy conservation and balance-of-payment discipline on East Europe may have had mixed success. Austerity in energy use and restriction of Western indebtedness may have some short-term financial advantages, but it tends to slow growth in completion of new projects that, in the long run, are vital to serving the same ends of improved growth and trade.[7]

B. Agenda of Issues

A Soviet energy debate, such as occurred in the United States after the introduction of the Carter energy program in 1977 and with the discussion of the energy legislation in the 95th Congress in 1978, can be inferred but is not detailed on the public record. In the 1974–75 period the Soviets committed scarce capital and investment resources to the Ural-Volga fields to maintain oil output. Such a policy was publicly supported by Soviet Planning Chief N. Baybakov.[8] In 1977 this policy was severely criticized by L. P. Guynovsky, an economist at the Tyumen Department of Economic Research of the Institute for the Economics and Organization of Industrial Production under the U.S.S.R. Academy of Sciences' Siberian Division. This article initiated an important policy shift which placed comparatively less emphasis on the Ural-Volga fields and more on the rapid development of West Siberia's Tyumen Oblast.[9]

The apparent switch in priorities toward West Siberian development has not, however, solved internal policy differences. A debate continues on where the greatest yield is to be found, and which regions should receive scarce capital and labor resources. According to Theodore Shabad and Leslie Dienes, "Even in the case of oil, where the proved reserve situation is least satisfactory, the problem is not seen as an absolute shortage of available resources or as a problem of import dependency. Rather, the "energy problem" in the Soviet Union is viewed basically as a question of supply and construction bottlenecks, investment requirements and lead times, retarding expansion." [10]

We will enumerate some of the questions that we assume have been central in such a broad energy debate and continue to be discussed. As will be discussed below as Scenario I, these questions would be related to the possible adoption of a comprehensive, complex, long-term energy plan.[11]

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[7] See Martin Kohn, "Soviet-Eastern European Economic Relations, 1975–78" and R. Dietz, "Price Changes in Soviet Trade with the CMEA and the Rest of the World since 1975" in *Soviet Economy in a Time of Change,* Joint Economic Committee, U.S. Congress, 1979.

[8] *Ekonomicheskaya Gazeta,* No. 1, March 1974, pp. 7–8.

[9] "Siberian Petroleum: Siberia's Contribution to the Country's Petroleum Might" in *Ekonomika i organizatsia promishlennovo proizvodstva,* No. 6, November–December 1977, pp. 35–43.

[10] T. Shabad and L. Dienes, *The Soviet Energy System,* V. H. Winston and sons, 1979.

[11] Discussed in more detail, below; Chapter IX. These questions were formulated by the author from discussions with Soviet energy specialists in preparation for the Bilateral US–USSR energy exchange scheduled for October 1979 but shelved. The following Soviet papers were among those available but not discussed due to postponement or cancellation of the meeting:

Beschinskii, A. A., and A. G. Vigdorchik. *Analiz sviaszi mezhdu tempami priorosta natsional'nogo dohkoda i tempami potrebleniia energiia* [Analysis of the Connection between the Rates of Growth of National Income and of Energy Consumption]:

Makarov, A., and L. A. Melent'ev. *Issledovaniia perspektivnoi struktury toplivno-energeticheskogo balansa SSSR i osnovnykh zon strany* [Research on the Prospective Structure of the Fuel and Energy Balance of the USSR and the Main Zones of the Country];

Styrikovich, M. A., and S. Ia Cherniavskii. *Puti razvitiia i rol' iadernoi energetiki v perspektivnom energobalanse mira i ego osnovnykh regionov* [Paths of Development and Role of Nuclear Power in the Prospective Energy Balance of the World and Its Main Regions].

OIL PRODUCTION AND PRICING COST ISSUES

1. How can and should oil exploration and proving out new reserves be accelerated? To what extent are new reserves tied to areas of technological weakness of the Soviet energy industry, e.g., exploring and exploiting offshore and Arctic reserves? To the extent priorities on current production and exploratory drilling are alternative tradeoffs, how can the appropriate mix be resolved?

2. In bringing in new deposits and production outside of the West Siberian fields—the area from which most new output comes—can and should high costs of production be subsidized or other aspects of development stimulated by monetary inducements? Is differential pricing for petroleum production use likely to be an effective means for reducing oil consumption and encouraging shifts to gas, coal, nuclear or other sources, as appropriate?

NATURAL GAS SUPPLY AND DISTRIBUTION

1. Are the high costs of remote-area development and long-distance transmission of natural gas to domestic and foreign markets an important barrier to gas-production expansion?

2. Are increases in imports of foreign energy equipment and technology—not just large diameter domestic pipe, but liquification equipment—critical to improving the attractiveness of expanded gas production transmission, and use? How significant is timely financing and operation of the Yamburg pipeline? [12]

3. Is natural gas export to smaller nations of CMEA, to West Europe and Japan an attractive substitute for oil exports in earning hard currency? With the higher delivery cost of gas to oil, is the price at the distribution point sufficiently higher to encourage a gas for oil policy and make it economically feasible?

COAL AND OTHER DOMESTIC SOURCES

1. As most of the economically useable coal deposits are in Siberia, are the development and transport costs too great to merit early emphasis on rapidly stepping up coal use in the primary domestic energy balance?

2. Is coal best, or only economically used, in the region of output, e.g. Kansk-Achinsk, Ekibas fields as noted in Plan Guidelines? [13] Is this tied to large coal burning, electric-power stations at the mine-mouth? How constraining will the development of long-distance transmission be to effective use of Siberian coal via coal-fired, steam-electric stations?

3. Is nuclear power destined to be only a factor of regional importance in the energy balance? Can the Soviet Union meet its own needs and also export reactors?

4. Are hydro projects in East Siberia of solely regional importance? Why does the new hydro capacity appear to be running ahead of load?

5. Are solar or other energy sources of any national or regional importance in Soviet plans?

[12] See Chapter IV above.
[13] *Pravda*, December 2, 1980.

1. Can price or allocation constraints effectively reduce hydrocarbon use in electricity, steam and hot water where other energy sources are quite adequate and less in short supply?

2. Is gas a reasonable substitute for oil use throughout CMEA? How can the shift be effective?

3. Are reductions of deliveries and hard currency pressures enough incentive to encourage East European countries to cut scarce hydrocarbon energy supply and consumption?

ADMINISTRATION OF ENERGY POLICY

1. Is the fragmentation of administration of energy production in oil, gas, coal, etc., among different ministries a problem in planning shifts in energy consumption?

2. To the extent very large energy complexes are needed for Siberian development, is the coordination of diverse ministries possible without a direct involvement of the highest Party and government levels?

3. To the extent the energy problem is a long-term problem, and long-term solutions are in conflict with short-term solutions, is there or can there be an effective long-term energy planning apparatus?

C. Public Policy Context—the Dilemmas of Choice

There seems to be some conflicts between short- and long-term policy in Soviet energy:

In the short run it seems expedient to use all available facilities to rapidly extract more oil from the rich Western Siberian fields. In the long run more efficient methods of recovery might show more output over time.

In the short run emphasis appears to be on production in existing fields with maximum output at minimum costs. In the long run expensive exploration of older fields as well as distant Siberian fields and offshore deposits might be productive.

In the short run reliance on West Siberian fields and domestic pipe may be less costly. In the long run longer transmission distances with improved quality, e.g., larger diameter pipe and refinements in transmission systems, may be more efficient.

In the short run continued use of oil may be less costly in investment than revising existing energy-using systems. In the long run conservation of oil may be of critical importance.

In the short run use of domestic oil and natural gas pipe may bring the energy to the users. In the long run efficiency in transmission, especially from gas, even requiring very wide use of imported equipment, may show handsome returns.

In the short run building more Siberian hydro and steam-coal fueled stations may serve local needs well. In the long run the perfection of long-distance transmission to bring Siberian energy to European load centers will be necessary for efficient electric power general and distribution.

Another facet of a long-term energy system is involvement of the domestic with foreign economies.

In the short run balance of payment problems and concern about the political burden of interdependence may lead to continued emphasis on a policy of independence. In the long run the maximum use of western energy equipment and systems will ensure more output and more efficient growth.

With limited investment funds, it is often difficult to commit large investments to developments with long gestation periods. However, to have an efficient, even adequate, energy system in the 1990's or thereafter an integrated comprehensive long-run plan must not only be agreed to at this time but underway to provide efficiently for future needs.

Whatever the commitment of resources to the administration of the Soviet energy program, there are inevitable and substantive uncertainties:

1. New discoveries; especially of oil, in establishing energy basins or new fields is difficult to predict. As noted by a leading Soviet geologist, M. M. Brenner, "We must deal with the fact that we have not yet found an all-encompassing instrument for reliably forecasting future discoveries and characterizing them qualitatively." [14]

2. Recovery rates may be favorably influenced by use of improved procedures of recovery. The geological conditions of the oil strata are influential, but so also are the methods of recovery. There is some uncertainty as to the long-term effects of short-term methods of recovery, e.g. the effect of water flooding.

3. The policies announced and followed in Soviet energy policy are subject to some uncertainty, especially in petroleum where the secrecy restrictions are the most stringent.

In view of the uncertainties and alternative policy approaches open to Soviet leadership in energy policy, it seems useful to examine alternative policy scenarios.[15] Although no definite time frame is envisaged, probably the period to the end of the Fifteen-Year Plan and Twelfth Five-Year Plan, 1990, is a useful temporal frame of reference. This time dimension permits current changes to be reflected in future output results.

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[14] "To Increase the Might of the Country's Petroleum Flow." M. M. Brenner. *Ekonomika i Organizatsiya Promishlennogo Proizvodstva,* No. 1, January–February, 1978, pp. 129–144.

[15] See John Hardt, Ronda Bresnick and David Levine, "Soviet Oil and Gas in the Global Perspective." *Project Interdependence: U.S. and World Energy Outlook Through 1990.* Committee on Energy and Natural Resources, U.S. Congress, November, 1977, pp. 817–820; and Robert W. Campbell, "Implications for the Soviet Economy of Soviet Energy Prospects", mimeo. United States Department of State, 1977; and Leslie Dienes and Theodore Shabad, *The Soviet Energy System,* V. H. Winston and Sons, 1979, pp. 287–294; and CIA, *Simulations of Soviet Growth Options to 1985,* March 1979, Bruce Everett, *The Economics and Politics of Energy Trade in the Soviet Bloc,* Unpublished dissertation at The Fletcher School of Law and Diplomacy, Tufts University, May 1980; Exxon, *World Energy Outlook* December 1980.

IX. SOVIET ENERGY DEBATE AND SCENARIOS FOR COPING WITH THEIR ENERGY PROBLEMS

By Ronda Bresnick and John P. Hardt*

There has been a different perception of the energy problem and the preferred approach to "solving" it within the Soviet bureaucracy. These perceptions have changed over time during the 1970's and underlie the shift from a view held from 1970–1977 that energy resources were great and the needs would be met in the normal course of economic development to a view adopted in December 1977 that special, ad hoc selective responses were required, especially to maintain oil output. As the 1980's begin, there seem to be increasing bases in Soviet policy discussions for a new view that a balanced, comprehensive Soviet program is needed, even though results may be limited in the short run and costs high. How the Soviets view their energy problem and act on it will influence whether they might approach the "best" case (rising oil output from 12 mbd in 1980 to 14 in 1990, respectively, with additional energy growth due to rising proportions of gas, coal, hydro and nuclear in their economy balance) or the worst case (oil peaking at less than 12 mdb, falling to 10 mbd by 1985 and 8 mbd in 1990.**

The Soviet leadership awareness of energy as a policy issue appears to be related to the range of possible outcomes in the 1980's and beyond and their acknowledged serious implications. From this debate, we may consider several scenarios, or possible outcomes as they proceed from the Twenty-Sixth Party Congress discussions in February 1981 to the elaboration of the Eleventh Five-Year Plan (1981–1985):

Scenario No. 1.—Adoption of a *Comprehensive, Complex, Long term energy plan;*

Scenario No. 2.—*A Selective, Ad Hoc Program*; and

Scenario No. 3.—*A Status Quo Program* in Energy Policy and Administration.

The first scenario based on a broad new energy program would be expensive in economic and political terms and risky as to short term results. The second scenario based on the 1977–80 pattern would reflect a continuation of the current policy of "muddling though." The third would imply a return to status quo ante 1977, status quo ante in terms of urgency, need and likely actions, and it would revive the balanced approach albeit at a lower level of urgency, to all energy sources. A question for the Eleventh Five Year Plan elaboration is whether Soviet policy makers support the 1977 Brezhnev approach of emphasizing oil output in West Siberia or the more later approach of balanced energy growth (coal nuclear, and oil/gas) with heightened

*Office of Senior Specialists, Congressional Research Service, Library of Congress.

**The "best" case is a scenario described by the ECE. The "worst" case is a scenario described by the CIA.

energy priority? There seems to be some evidence that a more balanced growth in the energy mix may have been stressed in deliberations prior to the 26th Party Congress. The official plan guidelines setting stable oil output, rapid growth in gas and atomic, modest increases in hydro and coal seem to bear this out.[1] This might lend itself to a longer term plan which would allow for a delay in likely eventual oil production drop in West Siberia, as well as expansion of absolute and relative shares of other energy sources. Soviet energy specialist Melentyev wrote:

> In the forthcoming period the task raised by the 25th CPSU Congress should be realized regarding reorganizing fuel energy complex in the direction of stabilization of the share of individual types of fuel, and in the future, in the direction of increasing overall production of energy resources. The reorganization will begin with a reduction in the share of oil as a result of the slow growth or even stabilization of absolute levels of its extraction. This should be compensated by accelerated use of nuclear fuel and coal and by the growth in the extraction of natural gas. . . .[2]

A. Soviet Energy Debate

A Soviet energy debate, such as occurred in the United States after the introduction of the Carter energy program in 1977 and with the discussion of the energy legislation in the 95th Congress in 1978, can be inferred but is not detailed on the public record. Therefore, we have enumerated in the previous chapter some of the questions that have been publicly discussed and those we assume have been or should be central in such a broad energy debate as the issue continues to be discussed. These questions may be related to the possible adoption of a comprehensive, complex, long-term energy plan, discussed below as Scenario I.

There are bureaucratic differences on assessment and policy issues in the U.S.S.R. due to uncertainties, limited information due to secrecy and parochial interests. There have been, likewise, differences, at the highest levels, on the appropriate energy policy to be followed.

1. Bureaucratic Differences in Assessments

Soviet officials face serious problems in accurately forecasting energy supplies. Their State Secrets Act severely limits disclosure of information on petroleum reserves and petroleum products. Penalties for unauthorized disclosure spelled out in their Criminal Codes would seem to be an effective deterrent to disclosure.[3] These restrictions limit internal disclosure within the research institutions of the U.S.S.R., as well as abroad.

The relatively low level of exploratory technology and the relative lack of exploration—as compared with the United States—limits the Soviet ability to accurately predict provable reserves and future output. Although they may have done enough exploration to have a good idea of what their reserves are, Soviet officials are privately very critical of U.S. estimates of their oil reserves, noting these figures are not widely available even in the U.S.S.R. Therefore, U.S. output estimates based on reserve to output ratios are challenged.[4]

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[1] *Pravda*, December 2, 1980.
[2] Planovoye Khozyaistvo #4, 1980, pp. 87–94.
[3] See JEC, Allocations of Resources in the Soviet Union and China—1977 for translation of current laws, pp. 160–161.
[4] Based on private discussions in Moscow, December 1980. This relates to such estimates as are made by American geologists in chapter VII, above.

Beyond the institutional constraints of secrecy and the technical constraints of sophistication in exploration capability and density of geological efforts to date, there is an inherent uncertainty in oil and other energy forecasts anywhere in the world. After careful appraisal and analysis of the state of the art in predicting supply constraints from oil and gas reserves, energy resource economist John Schanz output is critical, i.e., late in the 1980's rather than early as was the CIA earlier forecast.

> The realization that there are no measurements in oil and gas resource appraisals is important to impress upon everyone. Even in discovered reservoirs, we do not measure the oil in place—it is estimated. . . . The definitive study of future oil and gas supply and how it may be altered by economic and technological parameters that have not yet emerged still remains to be done. *It is of little comfort that the final, reliable, appraisal of the oil and gas resources of United States will prove to be historic rather than predictive.*[5]

Geologists note that although this may be true in detail, trends and gross estimates and projections can be made, especially in the time frame of a decade or two. It is also useful to note that many prominent American specialists predicted that oil output would peak long before it did in the United States.[6] The timing of peaking and fall of Soviet output is critical, i.e. late in the 1980's rather than early, as was the CIA earlier forecast.

Indeed, there are Soviet geologists who have also pointed out the uncertainties in prediction. E. E. Brenner wrote, "There is a continuing possibility of an apparently accidental but in reality completely logical discovery of new resources which formally go beyond the bounds of predicted estimates and evaluations." [7]

The uncertainty in estimating applies not only to probable and proven reserves, but recovery rates. To be sure recovery rates depend upon the size and type of field. There may be logic that various methods of extraction may lead to a fall in recovery rates, but most Western specialists seem to agree that prediction of precise levels of recovery is very difficult, if not impossible. Again, recovery rates are historic not predictive. Western estimates of Soviet oil and gas have employed a variety of methods to reduce uncertainty, including aerial photo graphs and other bases for resource inferences, careful analysis of published Soviet technical sources, and judicious use of emigres and other sources. The efforts provide a basis for making some reasonable estimates on a field-by-field and a national basis for the U.S.S.R. These American intelligence estimates might even be better than the Soviet's own estimates, although this seems to these authors unlikely. But they are, nonetheless, estimates, not reliable predictions or projections. Again, while they may reliably indicate a trend they are not likely to be able to pinpoint an exact number, e.g. oil output will not reach 12 Mbd in 1980 and will fall to 8Mbd in 1985.

At the same time, it might be argued that the Soviet planners strain their knowledge base, along with CIA, by precise predictions or planned targets. Soviet planners have, of course, changed targets in the last five years for 1980 from 620 million metric tons of oil to 620–640, then later to 606. Still their range of output targeted from changing plans has been well under 0.5 mbd for the Tenth Five Year Plan

[5] Italic added. John J. Schanz, Jr. *"Oil and Gas Reserves—Welcome to Uncertainty,"* Resources for the Future, Special Issue No. 58, March 1978.

[6] *Ibid.*

[7] *Ekonomika i Organizatsiya Promishlennovo Proizvodstva*, January 1978, No. 1.

(1976–80). The difference between Soviet planners and the CIA analysts on this count is that the former may, by priority based on their efforts influence—even control—the short run outcome, although to a degree Soviet oil geology may have the final word, in the long run.

The judgments on range of outcomes and factors that may influence outcomes differ in the Soviet professional community. Generally speaking, the differences follow a parochial pattern not markedly different to those elsewhere. Those seeking more funding for exploration and improved technology argue that although the prospects are good, without more resources there may be unfavorable outcomes. V. Krylov a geologist appeared to echo some of the CIA critique of water flooding techniques in calling for increased resources for technological change.[8] Also geologist Trofimuk talks about serious reserve to production ratio problems which can become serious without more exploratory work, thus arguing for more priority and resources.[9]

Another geologist, Salmonov, notes:

*** * * There are just as many debates going on at the second stage of development of Western Siberia, especially on how we should conduct development of the oil and gas fields here. Some experts propose production at a rate which would leave resources for future generations. I personally have nothing against this . . . But I cannot agree with those who argue that we have reached a peak volume of oil and gas production in Tyumen.[10]**

If changes were not made, he indicated, the output would fall. Likewise, those in the Ministry of Petroleum responsible for output, as expected, tend to understate potential, presumably so that they can more easily meet current and future plans. Those with regional interests in resource allocation argue for more investment in their own jurisdiction, e.g., "There is another 'Tyumen' in Tyumen." The implication being that the oil rich West Siberian province that has supplied more than three quarters of the incremental production in recent years may be able to continue to expand its output for the near future. Party leader Brezhnev: noted, "In the next ten years Tyumen oil and gas will continue to play a decisive role in supplying the country with fuel and energy." [11]

Another indication of what Soviet planners and leaders estimate or predict for the future is to observe what their pattern of action is in areas related to energy supply. There is an analytic approach that argues, for example, that if the Soviet energy infrastructure is expanding, then Soviet authorities must be confident that output is likely to continue to increase. More specifically, on this approach, one might make the following propositions:

1. If the Soviet Union projected that they will have a sharp turndown in oil output, they would not need new or expanded pipelines, storage facilities, primary and secondary refinery capacities, etc.

Selective evidence suggests that they are expanding these aspects of their energy infrastructure in the U.S.S.R.

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[8] V. Krylov. EKO. 1979. No. 2.

[9] *Sotsialisticheskaya Industriya,* July 1980, p. 2; *Literaturnaya gazeta* No. 3. Jan. 18, 1980.

[10] "Oil is born . . . in Debate" *Sotsialisticheskaya Industriya* July 12, 1980, p. 4.

[11] *Pravda,* 28 Nov. 1978. Also supported by Guzhnovski in "Siberia Petroleum: Siberia's contribution to the Countries Petroleum Might" *Ekonomika i Organizatsia Promyshlennogo Proizodstva* No. 6 Dec. 1977. Tony Scanlan of British Petroleum emphasised smaller fields in the Eastern regions of West Siberia, Komi peninsula, and off shore Caspian Sea as the sources in the 1981–85 period that will hold up aggregate oil output. "The Effects of Energy Development on East European Economic Prospects", at NATO symposium April 16–18, 1980. *Economic Reforms in Eastern Europe and Prospects for the 1980s.*

2. If the East European countries expected a fall below the 1980 levels of Soviet oil deliveries, they would be reducing industrial and other energy demand, preparing for a sharp turndown in growth.

They are, to be sure, shifting from energy intensive industries, such as petrochemicals, and obtaining OPEC oil from the new Adria pipeline, but not otherwise giving evidence of an expectation of fall below the 1980 levels of Soviet oil deliveries.

3. If, the Soviets and West European countries—especially FRG, France, Italy—expected a cutback in Soviet energy sales to those hard-currency countries, the Soviets would not be expanding their European energy infrastructure and making more commitments for imports requiring financing by hard-currency earning energy exports.

From this assessment of Soviet changes in energy infrastructure capabilities, one may say it is not their expectation to have a serious energy supply crisis, as implied by the CIA predictions.

In short, in Soviet policy circles, they do not appear by their actions to accept the CIA view that their oil output has peaked and will sharply fall by 1990, and that they will, therefore, become a significant net importer of oil to meet their own needs. Nor do they appear to necessarily accept the ECE projections of a significant increase of oil output from 12 in 1980 to 14 in 1990.

Perhaps, one might argue, the Soviet leaders and planners do not understand or have not understood the seriousness of their problem even though state secrets on petroleum reserves and other more complete related information controlled by the Council of Ministers are available to Soviet leaders. This seems unlikely. Moreover, they may conduct comprehensive surveys not possible for foreign analysts. Finally, if the leaders with all source access did not understand their problem as perceived by the CIA in 1977, it has certainly been brought to their attention and they have had ample opportunity by 1981 to review their assessments.

2. Energy Supply Proponents

The public discussion of the energy problem seemed to focus on the period between the December 1977 Plenum of the CPSU and the June 1980 Plenum of the CPSU on energy supply sources. Differing institutional and professional views were articulated before that date when many of leadership were involved. On one side in those time periods one might aline Brezhnev, the Party organization, the oil and gas ministries, the Supreme Soviet and officials who used the Party organ *Pravda* as a vehicle for expression. This group tended to focus attention on hydrocarbons (oil and gas) as the solution while deemphasizing nuclear, coal and hydro. The other group might be said to aline with the late Alexei Kosygin, the Council of Ministries (with the Gosplan), Coal and Electricity Ministries and officials using the government organ Izvestia as its vehicle. One might conclude that the debate was either focused or resolved by the June 1980 Party Plenum. Perhaps Kosygin's balanced energy development approach was winning out. A balanced energy policy, albeit at a lower level of priority, was the approach in 1976. In 1977 Brezhnevs' approach emphasising West Siberian hydro carbons was accepted. Perhaps now there is another switch in the offing to a balanced approach at a generally higher level of priority for all energy production. To illustrate the

nature of the public debate and the issues discussed we may be served by some detailed discussion about energy supply sources by various proponents and opponents in this time period. Erik Jones argues that Brezhnev and the Party organs supported a pro West Siberian oil and gas policy, while Kosygin and the government organs suggested a more balanced approach with coal and nuclear power receiving some emphasis.[12]

[12] Based upon an assessment of Erik Anthony Jones of the University of Michigan in draft dissertation, the following annotated references by Mr. Jones from Soviet sources may be referenced as supportive of the Jones view. His commentary on the sources is included. Additional sources with annotations by Mr. Jones follows:

(1) "Economic Levers and Increased Efficiency for the Mineral—Raw Materials Complex" in Planovoye Khoziaistvo. January 1978, in CPSP XXX #14, p. 11.

The Gosplan journal complains that coal prices are too low. May be interpreted as countering some views arguing for coal utilization.

(2) "Save Fuel and Energy, *Pravda,* September 26, 1978, CDSP XXX #39. A Party Newspaper singles out the Coal Ministry for Waste and overstating coal case for expansion in energy balance.

(3) "Save Fuel and Energy", *Pravda,* November 21, 1977, CDSP XXIX #49. Again a Party journal singles out waste of coal at Kuznets, downgrading coal.

(4) "Cut Heat Losses", Izvestia, July 5, 1979,; CDSP XXXI #27: Government newspaper notes positive actions of the *Ministry of Power and Electrification in improving efficency* of coal utilization in electric power generation. Thus favoring coal utilization.

(5) "By River Routes": *Pravda,* July 2, 1979, p. 2: CDSP XXXI, 1979, #26, p. 20: Party newspaper complaints that not enough ships are assigned for oil transport, and that shipping lines aren't meeting obligation to Western Siberian oil and gas workers. These factors, if corrected would help oil and gas meet incremental energy needs. Favoring oil and gas.

(6) In *Khoziaistvo i. Prava, "Otvetstvennost Postanovkov Elektroenergii"* #4 April 1979, by lawyer V. Tropin of the Tyumen Oblispolkom: An attack on the Ministry of Power and Electrification for breaking laws, causing great losses, and unequal action in fulfilling responsibilities in the area of electricity supply in Tyumen and in the Kuban (Brezhnev's pet agricultural area), Opposing coal proponents.

(7) DSP XXX, 1978, #36, p. 11; "To economize is to multiply "by P. Falalyev, USSR Deputy Minister of Power and Electrification in Izvestia, September 10; the article praises Ministry of Electric Power, and singles out the Ministry of Petroleum Refining and Petro-Chemicals for criticism on waste, and again a Government newspaper, focusing on hydrocarbon sources.

(8) "Use Gas Carefully". S. Orudzhev, USSR Minister of Gas Industry, *Pravda* June 14, 1978, p. 2; in CDSP XXX #24, p. 19. *Party* newspaper prints Gas minister's article which praises the work of the *Supreme Soviet* (Brezhnev's domain) in evaluating the present situationon saving fuel, energy.

(9) "Fuel Complex" Pravda Jan. 31, p. 1; CDSP XXXI #5. p. 20.

The *Party* newspaper critizes *coal* miners and *coal* managers for being slow on deliveries and other losses. Problem in the Oil and Gas Industry are blamed on the ministry for construction of oil, gas enterprises (i.e. the Party newspaper complain that they are not fulfilling their responsibilities to oil and gas workers).

(10) CDSP XXXI #8, 1979, March 21; Supreme Soviet Election speeches: *Kosygin* (p. 5): Praises, by name, Atomash and "the mighty Kansk Achinsk power, fuel complex". Vague reference to gas extraction in the east. No other reference to gas or oil. Favoring hydro, coal, nuclear.

(11) Brezhnev's speech. XXX #9 March 28, 1979, for Supreme Soviet Election. Praises by name: "Western Siberia—already the nations chief fuel and power base". No reference to coal or electricity, but favorable reference to oil and gas.

(12) CDSP XXXI # 12, p. 7.: "The Kansk-Achinsk Fuel Complex" Pravda March 22, p. 2. The Party newspaper criticize the Coal and Electricity ministries in their coordination.

(13) CDSP XXXI # 14, p. 21, Izvestia says problems at Kansk Achinck call for greater mobilization by the Krasnoyarsk Party Committee. By implication favoring coal.

(14) CDSP XXXI #14, p. 20. "What Lights Flicker" Izvestia, April 5, 1979, p. 20: Government newspaper claims that problem of constant level of voltage requires a technical solution (not critical of Ministry of Electrical Power. More investment and better equipment (rather than better management). Favoring electric power systems and by implication coal, nuclear and hydro.

(15) CDSP XXXI, May 9, 1979. "The Prospects for Power Engineering". Izvestia, April 11, p. 2–3.

——— Need to conserve petroleum and gas leads inevitably to an increase in the use of atomic energy.

——— (In the U.S.A.) the development of large scale atomic stations could jeopardize the fuel monopolies profits. (Oil companies are against nuclear power).

——— Radioactive waste: this is an important engineering problem, but it can be reliably solved for power engineering on any scale.

(16) Kommunist October, 1979. A party journal prints the first article that is bearish on nuclear power.

(17) A Filanovskv. Chief of Gosplan Oil Department. Moscow Planovoye khozyaystvo. #3 March 1980, p. 19–26.

The decrease of the average yield of new wells makes obvious the need for rapid growth in exploration drilling (2½ times current drilling). The 1979 plan was filled by only 82%.

(18) A. P. Krylov. Academician. Novosibirsk Ekonomika. Organizatiya Promyshlennovo Prolzvodste 1: 1980 p. 15.

The depletion index has risen by almost 150% in the last decade . . . indicating a steady decline in reserves from increasing well density per field. Well density is being increased beyond all national limits. Drilling should be shifted to new fields.

Subsequently a conference on energy was held at the Central Committee of the CPSU in June attended by top Party members including A. P. Kirelenko, M. A. Suslov, K. U. Chernenko, M. S. Gorbachev, V. I. Dolgikh and M. V. Zimyanin. This meeting was presumably not the special commission announced by Brezhnev in November 1979 but seemed to follow that plenum's energy policy lead. Kirelenko in his keynote remarks noted that "an increasing preferential growth in the energy potential of the national economy" was necessary to carry out the CPSU Central Committee instructions. Further he stressed "that a powerful new upsurge in our power industry be ensured in the Eleventh Five-Year Plan." In addition to priority or "storming" efforts for completing many energy projects underway he stressed the need for improved technical norms for improving efficiency of performance.[13]

B. Time for Decision

The Commission set up by Brezhnev "to solve the energy problem" may have reported to the Party Plenum in Fall 1980 which presumably approved the guidelines for the Eleventh Five Year Plan—the centerpiece of the Twenty Six Party Congress in February 1981. If this were the case the Fall 1980 Plenum would have been the vehicle for major energy policy decisions. There seems to be two major institutional and systemic difficulties in making progress on the increased growth of energy supply and more effective use of available energy in the domestic economy:

1. Without military-type clout and centralized Party administration a comprehensive program could neither command the necessary incremental resources nor give priority to the necessary plans and programs for a successful long term energy alternative. An organizational solution might be an Energy Council, like the Defense Council including full Politburo members common to the latter, e.g. Brezhnev Kirelenko and Suslov. The Politburo would presumably not oppose the recommendations of its top members. A role for administering energy policy that may be similar to the proposed, but shelved, U.S. Energy Mobiliization Board might be given to the Heavy Industry section under the Secretariat of the Central Committee of the Party, headed by Party Secretariat Member V. M. Dolgikh. Dolgikh's interest in energy policy in recent times fortifies this speculation. Another special commission under the State Planning Commission may have been set up under Chairman Baybakov.[14] The earlier reference to the presence of Suslov, Chernenko, Dolgikh, and others at the June 1980 meeting of the CPSU addressed by Kirelenko supports the earlier speculation.

The Energy Mobilization Board as proposed in the U.S. Senate has certain features that would seem appropriate for a Soviet top level energy council:

(1) Direct responsibility to top political authority, i.e. Politburo and Party Secretariat.

(2) Priority project procedure and decisions not subject to review or reversal by other than top authority.

[13] *Pravda*, June 4, 1980.
[14] David Walker, *The Economist Intelligence Unit, op. cit.* p. 2.

(3) Right to override objections, procedures, jurisdictional reservations of any jurisdiction "which presents a substantial impediment to completion of a priority energy project." [15]

In the context of a Soviet version of an "Energy Mobilization Board" the top Party and Government jurisdiction and support would provide the basis for issuing directions (postanovlenia) without fear of override from even the Politburo to all Party and Government agencies and units, including the regional party units, Councils of Ministries, Ministry of Defense Industries, etc.

A Party-Government directive in January 1970 upgrading the development of petroleum exploration and production in West Siberia included references to the Ministry of Defense Industries and led to a great acceleration in energy development in that region at that time.[16] Presumably this kind of organized clout would be necessary to follow Kirelenko's injunction for an "increasing preferential growth in the energy potential in the national economy".

2. As energy growth is coupled to GNP growth in the USSR, use of technical norms of more energy efficient Western nations would be necessary to conserve energy and improve efficiency. Use of the Soviet price system and administrative measures used for conservation and improved efficiency have been unsuccessful to date. It may well be that a Soviet price system or other mechanism designed to reflect relative costs and value will not be successful in bringing about improved efficiency in energy use. As some countries, notably Japan, have been able to markedly improve their energy/GNP growth ratios surrogate norms of performance might be adapted as appropriate from Japanese experience to the Soviet economy.[17]

3. Energy as a national issue. From at least the December 1977 Party Plenum, on the issue of energy was enscribed high on the agenda of the top Party leaders meetings. Highlighting the national issue of energy at the November 1979 Plenum meeting, Leonid Brezhnev noted, "it is necessary to give more thought to the entire complex energy-related problems." He illustrated his point by discussing a long list of problems related to increasing energy output, shifting the balance from oil to other sources, improved efficiency in utilization, etc. He came down strongly for an accelerated nuclear electric power program. Finally Brezhnev announced that, "A special commission has been set up to determine effective ways of solving the energy problem." [18] Although the guidelines for the eleventh 5-year plan (1981–85) give prominent attention to energy development, there has been no further public commitment to a comprehensive, long-term energy program.

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[15] *Senate Conference Report*, 1979.
[16] *Pravda*, Jan. 2, 1971.
[17] Martha Caldwell, "Japan's Policy Response to the Oil Crisis: Consensus and Contradiction in Petroleum Policy Making", paper prepared for Association for Asian Studies Convention, March 21, 1980. 22 pages.
[18] *Pravda*, Nov. 28, 1978.

X. IMPLICATIONS FOR U.S. POLICYMAKERS

By Ronda Bresnick and John P. Hardt*

A. Range of Soviet Outcomes and Foreign Policy Implications

Soviet energy supplies are likely to be primarily influenced by the uncertain availability of recoverable reserves and Soviet policy. Recognizing the inherent uncertainties in energy performance anywhere as well as the undecided status of important Soviet policy choices, we conclude that regardless of what U.S. or Western policymakers do, the Soviets may be faced with a range of different supply futures with a variety of foreign policy implications:

(1) In the "worst case" their oil and energy output, as a whole may be significantly less in 1985 than in 1980. This, in turn, may lead the Soviet policymakers to consider political-military options in the Middle East to avoid the impact of energy-supply shortfalls on economic performance in the U.S.S.R. and in CMEA. Energy shortfalls in any case would likely reduce hard currency trade, and limti Soviet energy diplomacy with the South and the West.

(2) In the "moderate" case or "best" case (projected by the ECE) oil and energy output, as a whole, may grow slower than in the past, but be adequate to meet continued growth needs of the U.S.S.R., CMEA, and hard-currency requirements of Western trade, and energy opportunities in the South. This, in turn, may lead the Soviet policymakers to continue to expand their energy diplomacy with the FRG and other Western industrial nations, critical neutral nations, such as India, client states, such as Cuba. Adequacy of energy would reinforce their strong hand through energy supply and other means within CMEA, e.g., the revived leverage on Romania through oil and gas sales.

Of course, if the ECE "best case" projections were accurate, the potential leverage of the U.S.S.R. through energy exports would be significant. The U.S.S.R. is now the only political and military superpower with energy export capability.

Energy equipment export policy of the United States should be assessed in this alternative Soviet supply context. Much of the debate to date in the United States has been made only in the "worst" case context.

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B. Influencing Soviet Energy Development by Energy Equipment Sales

1. Nature of the Debate

It has been argued by some in the U.S. government that by using export controls to limit or prohibit the sale of U.S. energy equipment and technology to the U.S.S.R., the U.S. can significantly influence Soviet oil and other energy production and distribution. Using this leverage the U.S. could further its own foreign policy interests by influencing a wide range of Soviet foreign and domestic actions, it is further posited by some.

In analyzing the policy implications of controlling the export of U.S. energy technology to the Soviet Union, the following central questions arise:

(1) *What are the appropriate and effective policy options open to the U.S. in controlling U.S. energy equipment exports to the U.S.S.R.?*

There are three options open to U.S. policymakers that have been discussed:

The embargo of all energy technology.—to deny across the board the export of U.S. energy equipment and technology to the Soviet Union.

"*Creative Economic Diplomacy*".—to link specific sales of U.S. energy equipment directly to Soviet behavior on a wide spectrum of issues such as human rights and actions in the Third World.

Energy interdependence.—to seek the development of long-term influence through increased trade and interdependence in the energy field, with less emphasis on the explicit linkage of export controls to possible short-term "foreign policy" gains.

The intent of the current Export Administration Act with respect to exports to centrally planned economies or Communist countries generally does not appear to support a policy of total denial. Whereas the Act does not clearly specify the broad uses of foreign export controls required to make a linkage policy explicitly consistent with the current law, a policy encouraging increased energy trade might also be consistent with the current law.[1]

(2) *How is the effective influence of U.S. energy technology on Soviet energy production measured? Are the Soviets dependent upon the U.S. for certain key energy technology imports?*

Measuring the ability of the U.S. to effectively and directly influence Soviet oil production through energy equipment exports is not a process of simple correlation or direct cause and effect. A rather precise knowledge of a variety of influences on petroleum industry performance and a rather sophisticated econometric analysis would be needed for accurate estimates. Also necessary would be a method of isolating the marginal effects of U.S. energy equipment and technology on their energy sector and their domestic investment plans correlated with the imports in order to assess absorption priorities and potentialities. In short, Soviet petroleum supply performance may be influenced by many interrelated factors other than equipment imports, which may be more significant in variation of performance.

[1] Arthur Downey, *The Export Administration Act of 1976: Law Policy and Practice* Speech in Dallas 17 June 1980 to Southwest Legal Foundation.

While it seems clear that the Soviets desire Western technology for energy exploration and extraction, the conclusion that they are dependent upon the U.S. for key energy equipment seems subject to question. The ability of the U.S. to effectively influence Soviet oil production or other Soviet energy-related activities by the use of export policy may therefore also be subject to doubt.

(3) *Does the U.S. have the capability to hold down Soviet oil output? If so, do we wish to encourage a decline in production if it increases the prospects that the Soviet Union and Eastern Europe may become net importers of energy on the world market?*

There seem in turn to be three schools of thought relative to the potential of significant influence from U.S. energy equipment exports:

Nothing will help them in the short run school.—The Soviet Union may be in the world market for oil regardless of U.S. energy technology exports. It is that Soviet oil production will decline in the 1980's in the "worst" case and that efforts as well as imports of U.S. technology will not have an appreciable effect in the short run.

U.S. sole supplier, critical margin school.—Much of the energy equipment and technology desired by the Soviets is available primarily or exclusively in the U.S. Much of this equipment is essential to the Soviets and they have a *critical* need for it. Because of this critical need, the U.S. has an effective lever which may be used to influence Soviet behavior. Short run influence over the Soviet export-import position is possible and desirable through a manipulation of key U.S. energy exports. This appeared to be the Carter administration embargo policy view on energy equipment exports to the USSR.[2]

Long-term cumulative impact school.—The U.S. is likely to be of only modest influence over the Soviet export-import position in the short run, but may have incremental influences over the medium and long run if there is energy cooperation.

All petroleum equipment and technology is available, it is argued by U.S. energy companies, from other Western industrialized countries in sufficient quantity. If we refuse to sell to the Soviets, or try to link energy exports to political behavior, the Soviets will go elsewhere to buy their energy equipment. The Soviets may even choose non U.S. sources for their first choice.

In the long run, the U.S. may have significant influence if interdependence between East and West grows, especially if Western systems of energy management are transferred to the Soviet Union, e.g. large energy systems such as Yakutia natural gas or Caspian Sea offshore oil.

This appears to be the energy company view and that of many Europeans.

2. Appropriate and Effective Influence: Policy Options

With regard to the export of U.S. technology to the U.S.S.R., and specifically the export of energy technology, there seem to be three policy options as referenced in question (1) above.[3] Each of these

[2] Letter from Secretary Philip Klutznick to Speaker Thomas O'Neill, Jr., December 31, 1980 in conformance with Export Administration Act. (Hereafter *Carter Export Control Policy.*)

[3] *Supra.*

options can be related directly to the subject of U.S. energy technology exports to the U.S.S.R.

(1) The embargo of energy technology: The denial option

This policy option, characterized in the 95th Congress by the *Technology Transfer Ban Act of 1978*,[4] would deny all energy technology to the Communist countries, on the assumption that much or most of the energy produced in these countries with American equipment would support directly or indirectly, military might. Associated with this approach is the assumption that U.S. energy technology can significantly affect Soviet oil production and exploration, and that denial of that technology would be in the best interests of U.S. foreign policy objectives, while detrimental to Soviet interests. Some supporters of this view see the Soviet system as embodying strong, persistent restraints on innovation and argue that the USSR will fall progressively further behind the West over time if innovation cannot be importted regularly. This policy may be considered a version of the so-called "zero sum game" approach where whenever any benefits accrue to the East they are viewed as costs to the West and vice versa.

Opponents note that trade does not take place unless there is mutual gain. They argue further that the West as a whole is not playing a "zero sum game", and thus if the United States is losing export sales and gaining only marginal or questionable influence over Soviet oil production, what gains have we made?

The export denial option might involve a return to the Export Control Act that was replaced by the Export Administration Act of 1969. This earlier Act involved the dual control objective of limiting exports of both military and economic potential and effectively controlled and barred all technology transfer from the United States to the East. Our Western allies in COCOM would likely not follow this restrictive pattern today. Thus a return to the pre-1969 policy might not be effective in limiting exports from the West.

If the U.S. had the capability to hold down Soviet oil output, do we wish to do so if it increases the prospects that the Soviet Union and Eastern Europe may become net importers of energy? If the CMEA countries shift from a net exporter to net importer position, other things being equal, they will tend to drive up OPEC prices and restrict foreign sources of supply for the U.S. and the West. Should out influence indeed be of some significance through energy equipment restrictions, do we want to encourage the Soviets and East Europeans to become importers of oil, competing with the U.S. on the world market? Or alternatively, do we want to encourage the sale of U.S. energy technology to increase Soviet oil production, so that more oil will be added to total world market supplies? Are more sales of U.S., rather than foreign, energy equipment appropriate to facilitate the increase in Soviet energy output?

While there is a wide spectrum of views in the West on the Soviet energy export-import position and the ability of the West to influence that position, a widely held view holds that we would have little leverage in the short run.

This may be called *Nothing will help or hurt them in the short run school.* According to the CIA, Soviet oil production will decline in

[4] *Congressional Record.*

the 1981–85 period regardless of domestic Soviet efforts or imports of foreign energy technology.

The Soviets are not finding and developing new oil deposits rapidly enough to offset declines in their older fields, while production techniques now in use focus on short-term gains at the expense of maximum lifetime recovery. *Even if development of other energy sources is pushed to the maximum, we expect a sharp slowdown in the annual rate of growth of energy output—from an average of 4 percent in 1976–80 to not much above 1 percent in 1981–85. Unless the* U.S.S.R. has unprecedented success in its exploration efforts over the next three to four years, oil output likely will continue to decline after 1985. Much prospective territory remains to be explored in East Siberia and the offshore areas of the Caspian Sea and Arctic Ocean. But unless substantial discoveries are made soon, long lead times will prelude any significant boost to production before 1990.[5]

The "nothing will help them" view brings into question the utility of Western energy technology to substantially boost the growth of Soviet energy production, and would also seem to bring into doubt the utility of such technology to substantially slow down a decline in Soviet production in the near term. Taking this pessimistic view of the Soviet energy position, the Soviets would likely become oil importers regardless of any immediate infusion of Western technology. While Western technology may also be critical to shortening the time required and improving the effectiveness of Soviet efforts to expand utilization of Siberian energy reserves in the long run—after 1985—this view holds that the importation of the needed Western energy equipment may be severely limited by the reduced Soviet access to hard currency and credit in the West. Energy exports have been the prime source of hard currency, to date. In this context, we have little energy equipment export leverage in the short run to play a critical role, and the ability of the U.S. to significantly influence Soviet energy production or the energy export-import position would be limited. Therefore in the short run the absorbtion problem would negate the favorable impact energy equipment might have on Soviet supplies; in the long run balance of payment constraints would limit their financial capacity to import needed energy equipment.

(2) *"Creative economic diplomacy": The foreign leverage option*

This policy option, perhaps most articulately expressed by Professor Samuel Huntington while at the National Security Council would attempt to use U.S. energy exports as a lever in U.S.-Soviet relations for foreign policy purposes when the equipment and technology is adjudged of "critical need" to the Soviets and when the Soviets are "largely dependent" on U.S. energy equipment supply. Huntington argued that U.S. energy equipment controls can be a particularly relevant and significant foreign policy tool. This view emphasized that the U.S. was the *sole supplier* of technology *critical* to the Soviet energy industry. Withholding the critical technology, it was reasoned, would allow the U.S. leverage over Soviet activities. It is presumed that by withholding such technology the Soviet energy production and export-import position would be significantly and adversely affected.

[5] Testimony of Stanfield Turner, then Director of CIA. "Allocation of Resources in the Soviet Union and China—1978" Hearings before the Subcommittee on Priorities and Economy in Government of the Joint Economic Committee, U.S. Congress, p. 61. [Italics added.]

The problem here is that the degree of Soviet need or reliance on U.S. technology has not been clearly established, even for petroleum exploration equipment. James Giiren, when President of Armco International, testifying before the House Foreign Affairs Committee, stated that: "A substantial quantity of all geophysical equipment in use by American oil companies is available overseas with no reduction in quality and reliability." [6] Others have suggested that indeed the U.S.S.R. has a critical need for certain U.S. energy technology which is not available abroad. The full assessment of foreign availability was mandated by the Export Administration Act of 1979 but has not yet been made available.[7]

Who should accept the burden of proof, those wishing to sell energy technology to the U.S.S.R. or those proponents of export controls? According to the current Export Administration Act, the burden appears to be placed on the export licensers rather than the exporters.

Previous legislation granted the President largely unlimited discretion to control exports for foreign policy purposes. One of the purposes of the new legislation in 1979 was to provide standards to govern the use of such controls.

The Export Administration Act of 1979 provides that all foreign policy controls will expire at the end of each calendar year unless renewed. The President must notify Congress of the annual renewal of each control and justify its renewal on the basis of the criteria established in the Act.[8]

The related section of the communication of the President to Congress dealing with "Petroleum Equipment to the USSR" stated in part:

The control on the export of petroleum equipment to the USSR provides a flexible foreign policy tool. When necessary and appropriate it can be used to sensitize the Soviets regarding actions which are damaging to United States foreign policy interest.

The United States supports the improvement of bilateral economic relations. At the same it is recognized that improvement in one sector of the bilateral relationship cannot be long sustained if it is not accompanied by improvements in other areas. Discontinuation of this control would represent a change in policy not warranted by existing circumstances in our relationship with the USSR.

Among the various means of furthering U.S. objectives vis-a-vis the Soviet Union, this control continues to be useful.

While the United States Government can effectively control exports of U.S. produced petroleum equipment, for most items adequate quantities of similar equipment are available from foreign sources. There is only *limited foreign availability* of some deep submersible pumps and seismic equipment.

The effect of the controls of U.S. exports can be only roughly estimated since other factors affect the data. Although no license applications have been denied since the control was imposed in August 1978, some exports have been lost.[9]

Measuring the ability of the U.S. to effectively and directly influence Soviet oil production through the sale of energy equipment and

[6] Hearings. Subcommittee on International Economic Policy and Trade of House Foreign Affairs Committee, February 22, 1979.

[7] The Office of Technology Assessment is currently examining the question of the degree to which U.S., as opposed to other Western technology, might contribute to Soviet energy availability in the coming decade. This study is scheduled to be completed in the summer of 1981.

[8] The President's notification to the Congress of his renewal of export controls for foreign policy purposes for 1980, together with an enumeration of those controls and the rationale for the extension of each control was provided to Congress as required by the Export Administration Act of 1970. See letter from President Carter to Speaker Thomas P. O'Neill, Jr. December 29, 1979 in Congressional Record January 1980, pp. H380–384. See also *Carter Export Control Policy, supra.*

[9] Ibid. H381 (Italics ours).

technology does not appear to be a process of simple correlation or direct cause and effect, as noted in the President's letter. Dr. Huntington had stated: "It has been estimated that Soviet oil production would today be 10–15% less than it is, were it not for recent imports of certain types of Western technology.[10] Doubtless, Soviet oil production might have been 10–15% less than it is today for a variety of reasons. Other factors, such as Soviet management practices, availability and quality of domestic equipment, energy equipment imports from other countries, natural phenomena (weather, etc.), probably affected Soviet petroleum output. Rather precise knowledge of a variety of influences on petroleum industry performance and a rather sophisticated econometric analyses would appear to be required to assess Dr. Huntington's statement. Yet information regarding performance is closely guarded by the Soviet Secrecy Acts, and there are few Western econometric analyses publicly available. The part of the Carter letter indicating the difficulty of assessing effects of controls "since other factors" are relevant is not only appropriate as a caviat but may nullify the creative diplomacy approach in terms of the critical supply assumption.[11]

Even with the appropriate analysis, the utility of an econometric study would be limited, as critical assumptions on the nonquantifiable variables would tend to drive the conclusions. Likewise, even the available output may be subject to a variety of reporting distortions. Parenthetically, one might also query whether a single variant analysis of the type suggested by Professor Huntington is possible or useful in assessing variations in American oil output.

U.S. energy equipment imports are absorbed in, and adjusted to, an existing or developing Soviet system of energy exploration and production. To measure the impact of U.S. energy technology we would need to know what the primary Soviet motive for imports were and make assumptions about priorities which gave rise to changes in the level of imports. As most critical Soviet data on energy policy, petroleum reserves, exploration, production, distribution, refining—that is, most relevant quantitative aspects of the Soviet industry—are covered by Soviet Secrecy Acts with severe penalties for disclosure, a quantitive basis for assessing the impact of U.S. equipment imports would probably need to be inferred either by: (1) knowledgeable Western analysis based on what is discussed in Soviet open literature; (2) inference on need drawn from the logic of Western orders; or (3) information extracted from our satellite or other intelligence reports. Although the use of covert sources may be of some utility in this regard, those data would probably be of limited value in the formulation and implementation of the kind of model required by the problem.[12]

Another assumption which would be needed in order to measure the impact of U.S. energy equipment imports on Soviet oil production would concern the ability of the Soviet Union to effectively absorb and

[10] Samuel Huntington, "Trade, Technology, and Leverage: Economic Diplomacy," Foreign Policy, No. 32, Fall 1978. (The article was adapted from an address at West Point in June 1978. p. 69.)

[11] *Carter Letter to O'Neill, 1979, supra.*

[12] It may be that an estimate such as that used by Professor Huntington on the effect of Western technology on the Soviet energy industry would have to be primarily supported by assumptions and estimates of effective Soviet utilization of imports, inferred Soviet priorities, presumed end use of U.S. equipment, and other key variables, rather than verifiable and quantifiable data drawn from primary sources.

utilize the equipment and technology. We should not easily assume that the U.S. equipment absorbed in a Soviet energy system will be as effective as would be the case if employed in comparable American operations.

Let us assume, for the moment, that Western imports are critical to Soviet oil production and discuss in more detail what type of equipment appears to be involved to test the sole supplier assumption. It seems clear that the Soviets desire Western energy technology for purposes of exploration and extraction. In order to prove out and extract oil and gas reserves from East Siberia, the Arctic and offshore regions (all of which require expensive and technologically sophisticated equipment), new techniques—most now available only in the West—will be necessary.

Equipment and technology of particular utility to the Soviets include:

(1) Fluid lifting equipment such as high-capacity electric submersible pumps and gas-lifting equipment.
(2) Deep drilling equipment for oil wells in the Caspian Sea and Arctic areas.
(3) High-quality drilling bits.
(4) High-quality steel for rigs and drill pipe.
(5) High-quality seismic equipment.
(6) Large diameter pipe.
(7) Rotary rigs.
(8) Casings.
(9) Multiple completion equipment.
(10) Secondary and tertiary recovery technology.[13]

The list is somewhat shorter in the Carter Administration assessment in December 1980.[14]

The availability of energy equipment from the west required by the Soviet industry can be broken down into three basic categories: (1) Equipment available primarily or solely in the U.S.; (2) equipment available in other Western countries of comparable quality; and (3) equipment available in the other Western countries of lesser quality. A central question is what proportion of the energy equipment needed by the Soviet petroleum industry is in the first category—U.S. as a sole source. A debate over the Western availability of energy technology needed by the Soviet Union has been taking place among participants from the Federal Government, academia and private industry. Professor Huntington has written:

. . . It is necessary to review and revise existing lists of embargoed goods and technology so as to require, on foreign policy grounds, validated licenses for those items of machinery and technology for which the Soviets have a critical need, and for which they are largely dependent upon the U.S. supply. All such items should be controlled regardless of the extent to which they are likely to be used for military purposes. In other words, we should put ourselves in a position in which the technological door can be more easily closed, or swung nearer to being closed, if that seems desirable or necessary.

The President's decision, in July, 1978, to put on the Commodity Control List (CCL) exports to the Soviet Union of technology and equipment for the exploration and production of oil and gas, is a major step in this direction. *For many items in this area, including downhole pumps, gas-lift equipment drill bits, well-completion equipment, and offshore drilling technology, the United States has*

[13] Based on a variety of CIA studies, particularly, "Prospects for Soviet Oil Production: A Supplemental Analysis," July 1977.
[14] *Carter Export Control Policy, supra.*

virtually been the Soviet Union's sole supplier. This type of equipment is absolutely essential to the Soviets if they are to stave off a significant decline in their oil production in the early mid-1880's. (Italic added.)[15]

In contrast, several private industry spokesmen have raised serious doubts in Congressional testimony of the sole supplier thesis, suggesting that the U.S. does not have a corner on energy technology. According to members of the Petroleum Equipment Suppliers Association,

> Virtually all oilfield product or service is available from a number of non-U.S. sources. Whether it be in the area of exploration and drilling, well completions, or hydro-carbon production companies located in Europe, Asia or in this hemisphere outside the United States, can easily fill any gap which the withdrawal of U.S. products might create. With regard to petroleum equipment, we simply do not have the leverage to affect Soviet policy by the denial of export licenses.[16]

A more thorough demonstration of the extent of alternative sourcing for energy equipment and technology appears to be indicated if we are to adopt a policy of more extensive use of controls based on limited foreign availability.

As noted above, even if it should it be demonstrated that the U.S. is, in some cases a sole supplier of energy technology to the Soviets, one must ask whether that in itself will afford the U.S. effective influence on Soviet energy production. As noted earlier, it would need to be demonstrated that the U.S. energy technology is *critical* to Soviet energy production and exploration.

Even if U.S. exports are critical and the U.S. is the sole supplier, Soviet energy production may be only marginally affected by the availability of U.S. equipment and technology in the short run. The lag time involved from purchase to delivery, absorption and effective utilization problems, as well as the availability of such technology from other industrialized countries, may substantially lessen the short-run impact of U.S. influences. Short-run impact may be viewed as critical to action affecting contemporary foreign policy issues, the essential of the "creative diplomacy" approach.

In the longer run, we may find that controlling exports merely encourages the Soviets to develop their own technology, or seek other foreign sources, should they desire to do so. The NATO embargo of oil pipe in 1962 led directly to increased Soviet domestic pipe production and a search for alternative foreign availability.

Ultimately even if all of the above discussed conditions were valid in the Huntington thesis (i.e. sole supplier, critical impact), the Soviets could and likely would, based on their historically demonstrated pattern, take the economic cost rather than accepting the political cost inherent in "capitulating" to overt U.S. leverage.[17]

The response of the Carter Administration to the requirements of the Export Administration Act of 1979 on December 31, 1980 indicated a general continuation of the Huntington policy to the end of the Carter Administration.

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[15] Huntington, *op. cit.*

[16] Letter from William J. Sallans, Executive Vice President of Petroleum Equipment Suppliers Association to Robert Russell of the Senate Committee on Banking, Housing and Urban Affairs. In, "Use of Export Controls and Export Credits for Foreign Policy Purposes," Hearings before the Committee on Banking, Housing and Urban Affairs, U.S. Congress, Senate. October 10–11, 1978, pp. 244–245.

See also U.S. Congress. House. Committee on International Relations. "Export Administration Amendments of 1977." Report. 95th Congress. 1st Session. April 6, 1977. Washington, D.C. GPO. p. 3. Also see Ronda Bresnick, "The Setting: The Congress and East-West Commercial Relations," *Issues in* East-West Commercial Relations. U.S. Congress. Joint Economic Committee. January 1979. pp. 1–11.

[17] Letter from Secretary Philip Klutznick to Speaker Thomas O'Neill, Jr. December 31, 1980.

Control on the export of oil and gas exploration and production equipment and technology continues to provide a *flexible freign policy tool* to be used, when necessary and appropriate, to sensitize the Soviets regarding actions that are damaging to United States foreign policy interests. The effectiveness of this tool is limited by the availability of equipment and technology in other countries. However, the United States produces much of the best equipment and is the best source for offshore technology . . .

There has been adverse Soviet reaction, specifically in the form of a Soviet determination that the U.S. should be a supplier of last resort for oil and gas equipment. No other country has imposed a similar control. Other Western suppliers have substituted for U.S. exporters who had expected to receive orders . . .

In FY 1980 approximately $42 million worth of applications were approved, a slight increase from FY 1979. The existence of the control has caused some lost exports, especially for gas lift equipment. There is little evidence to indicate that the control has had a serious impact either on the producing industry, on employees, or on the communities in which the products are made, or that it has damaged the international reputation of the U.S. as a reliable supplier, outside of the USSR. . . .

Applications to export technical data and equipment for manufacturing oil and gas production and exploration equipment will be acted upon with a presumption of denial.

(3) Energy and economic interdependence

Another view, the long term cumulative influence school holds that the role of U.S. energy equipment and technology might be cumulative in the long run and that the potential impact of American energy equipment would be greatest in systems transfer over the long term.

A long-term impact on the Soviet energy position may come from a movement toward increased East-West industrial cooperation in energy—even joint ventures. Indeed, it may be that the U.S. will gain some influence over Soviet energy activities in the future, by exporting U.S. equipment and technology now.

This policy option implies that a continued long-term cooperation between the U.S.S.R. and the U.S. on energy, as expressed through trade and industrial cooperation will increase the ability of the U.S. to influence Soviet activities. Exporting U.S. energy and equipment over a long period would play down possible short-term influences and in the long-term be mutually beneficial to the U.S. and U.S.S.R. Such a development might be in the economic and foreign policy interests of the U.S. while consistent with our current export promotion and administration laws.

Does experience indicate that long-term influence trade is possible? Should only minimal influence be possible even in the long-run, would the economic benefits derived be reason enough for trade?

According to Marshall Goldman, testifying before the House Foreign Affairs Committee on export controls:

. . . overall it seems in the best interest of the world that it should seek as high a production of basic raw materials such as oil, natural gas and coal as possible regardless of who is the producer. It is true that if the Soviets are the producers, that it also strengthens the Soviet Union, but at the same time we should have as many diversified sources of supply as possible.[18]

In this respect increased trade is seen as mutually beneficial rather than as a zero sum game.

[18] Hearings, House Committee on Interstate and Foreign Commerce, Senate Committee on Energy and Natural Resources. U.S. Congress. November 1977.

The most economically beneficial arrangement for the Soviet Union in technology transfer would be one in which a long-term contractual relationship with Western companies were established. This arrangement would involve Western companies as general contractors, partners in management of transfers and cooperative agents in the marketing of products. Joint ventures are the usual form for such a collective relationship, which U.S. multinationals employ effectively elsewhere. Some aspects of this arrangement involving equity and foreign involvement in managerial decisions have been to date politically unacceptable to the Soviet Union while encouraged by the Yugoslavs, Romanians, Hungarians and Chinese. This arrangement, keyed to large complexes, might significantly improve the effectiveness of technology transfer and shorten the time required to bring projects on stream if adopted in U.S.-Soviet commercial relations.

From the American side this long-term commitment has the utility of providing an expanding market with reasonably predictable returns on investment. The Germans, for example, appear to find their pipe-for-natural gas deals such as Yamburg relatively attractive economically and politically "stabilizing", indeed the keystone of the largest East-West trade relationship.[19] The El Paso project for natural gas from Yakatia and East Siberia and the Phillips/ARMCO project for off shore oil in the Caspian Sea are active proposals of this long term systems transfer nature.[20] With appropriate concern for meeting national security criteria, identifying and controlling critical technology transfers and other exports required by the Act, a pattern of such long-term relationships might be attractive in U.S.-U.S.S.R. relations. What troubles the Soviets and West Germans alike in their long term relationship is the risk and cost of interdependence, i.e., the mutual, increasing cost of dependence on each other. The influence from this kind of relationship by the United States would be substantial and build over time as it has in the grain trade area. If our imports from the U.S.S.R. were not critical to us, but valuable, we might find the dependence cost relatively modest, e.g. any amount of energy the Soviet Union is likely to be able to export to us would be a small part of our total supply; whereas in critical large Soviet projects our transfers to them might provide sources of considerable influence. This kind of balance in dependence might be different for the FRG, relying as they do or will increasingly, on Soviet natural gas.[21] In any event it should note that *our* investment (the Soviet gain), in such arrangements is sunk or fixed early. Their dependence is only *after* plant/system is operational. Their payback (our gain) is long term, at risk, and interruptable.

As the Export Administration Act is reviewed and applied, clarification of the following questions associated with the above stated policy options may be useful:

(1) Should the law be amended to facilitate the earlier more restrictive control policy limiting exports if they should contribute to industrial as well as military capability—the technology transfer ban ap-

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[19] See chapter IV, *supra*.

[20] James P. Lister, "Siberia and the Soviet Far East: Development Policies and the Yakutia Gas Project." At *NATO Economic Colloquium*, April 23–25, 1979, p. 15.

[21] See discussion of credit worthiness ad risk in earlier discussion of North Star/Yakutia projects in Senate Foreign Relations Committee, Western Investment in Communist Countries, GPO, 1974, *supra*.

proach. This might or might not await the 1983 expiration of the current law.

(2) Is linkage or "creative economic diplomacy" an option that should be clarified in the law or left to interpretation by those administering export controls? The annual presidential statement on use of controls for foreign policy purposes would give the Congress the necessary oversight for applying this option. How does Congress wish to delineate the uses of export controls for foreign policy purposes in accordance with the law? Should the Export Administration Act be interpreted to prevent the use of export controls from being used for foreign policy purpose contrary to the intent of Congress? Is foreign availability so pervasive and other Western industrial nations standards of export control so dissimilar to ours as to preclude an effective U.S. policy based on licensing of energy equipment?

(3) If long term energy cooperation is desired, should U.S.-USSR energy cooperation not only be permitted but encouraged? Government financing and other facilities would require a US-USSR trade agreement. Are the mutually necessary conditions likely for consumating a trade agreement and normalized economic relations? Specifically must repeal of the Church and Stevenson amendments to the Export-Import Act and modification of the waiver provisions of the Jackson-Vanik amendment to the Trade Act be conditions precedent to energy cooperation? If these changes in our economic policy with the USSR cannot be made does this rule out effective energy cooperation?

C. Agenda of Issues for U.S. Policy Consideration

There is a range of Soviet outcomes: energy deficit with an attendant politico-military threat or energy exporter with the USSR as an energy diplomat. If the former—energy deficit—then inhanced U.S. concerns for the security of the Middle East would be in order, a new quick response naval/ground capability would be of increasing relevance. The instability of the region, underlined by the Iranian revolution, and the continued dependence of West Europe and the United States on the oil supplies of the region would continue with some perceived need for U.S. and NATO adjustments.

If the later—energy exporter—then enhanced U.S. concern for a dependence of West Europe countries and selected developing nations would be in order. Soviet outcomes would effect U.S. policy considerations:

1. Policy on Energy Equipment Sales

If denial is effective in economic and foreign policy terms, we may wish to adopt the appropriate policies for use of energy equipment supplies as a lever in diplomacy. We may, however, conclude that, the beneficial impact of long-term energy relationships provide more foreign policy benefits to us in dealing with the Soviet Union. In this case, we may re-examine the joint large-scale energy development policies proposed in the Nixon-Peterson era. We may eventually conclude that we have no effective policy options for use in energy equipment supply diplomacy.

Judgments of these variants of U.S. use of energy-equipment-supply diplomacy should be significantly influenced by the outcomes in energy performance in the U.S.S.R. We may find the U.S.S.R. as an energy exporter energy diplomat quite a bit more threatening than as an energy deficit/political-military threat in the Middle East. In any event, we would have to adjust our perspectives for preparing an appropriate U.S. policy with a view to the widely different alternative Soviet foreign energy postures.

2. U.S. Energy Supply Diplomacy

As long as we remain critically dependent on insecure Middle Eastern oil supplies we are vulnerable to foreign policy actions of all nations with influence in that area, including the Soviet Union. Quite aside from Soviet action we may need to take political-military action to secure oil sources. We are also likely to continue to be concerned about similar insecurity of West European nations and Japan.

To the extent the United States and other Western nations may become less dependent on these sources our foreign policy options may be expanded or made more flexible. As energy from different sources, including the USSR provides security through diversity of supply sources we may wish to expand energy imports from all non-Middle Eastern nations, including the USSR.

In relation to energy deficit developing nations we may wish to provide alternative sources and attempt to keep prices down or finance deficits.

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