THE SOVIET ENERGY PROBLEM: WHAT POLICY CHOICES WILL IT REQUIRE?

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A review of Leslie Dienes and Theodore Shabad, *The Soviet Energy System* (New York: John Wiley and Sons, 1979) and Robert Lewis, *Science and Industrialization in the USSR* (New York: Holmes and Meier, 1979).*

A lively debate is going on over reports that the Soviet Union, currently the world's largest producer of oil and its third largest exporter, faces an imminent leveling off and possibly a decline in its oil output.** There is nervous speculation that the Soviet bloc may soon depend on oil imports, thus putting further pressure on energy prices around the world, or worse yet, that the Russians may cast a greedy eye on the Persian Gulf, attracted by the possibility of satisfying both their strategic ambitions and their oil needs at a single grab. These are frightening possibilities, it hardly requires saying, and with East-West relations already tense, it is especially important to be clear on what the Soviet energy problem actually consists of and where it may lead. Fortunately, we now have an excellent new book on the subject by two highly competent economic geographers, Leslie Dienes and Theodore Shabad.

With a wealth of evidence, Dienes and Shabad show that the Soviet energy problem is in several respects a mirror image of that of the West. Though the immediate source of the Soviet difficulties is an unexpectedly sudden decline of oil output and known reserves in West

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**The chief catalyst for the debate has been the series of reports issued by the National Foreign Assessment Center of the Central Intelligence Agency, *Prospects for Soviet Oil Production*, ER 77-10270, April 1977, and *Prospects for Soviet Oil Production: A Supplemental Analysis*, ER 77-10425, July 1977. For a more recent discussion by two CIA analysts, see J. Richard Lee and James Lecky, "Soviet Oil Developments," in U.S. Congress, Joint Economic Committee, *Soviet Economy in a Time of Change*, Volume 1 (Washington, D.C.: USGPO, 1979), pp. 581-600.

Siberia, the chief problem this poses for the Soviet Union is not that of mustering imports but of maintaining exports, which earn half of the Soviet hard-currency income and provide a community of interest that helps to keep the Soviet bloc stable. Unlike the United States, the Soviets do not compete with their allies for energy; they supply them. Potentially, beyond a tough decade in the 1980s, they stand the closest to true energy independence of any industrial power. Moreover, Dienes and Shabad argue, the Soviet energy economy has been, on the whole, competently and rationally developed. It has benefited from consistently high priority in the regime's investment plans, receiving since 1928 about 30 percent of all productive capital invested in industry. (D&S, p. 6.) Its allocation strategy and pricing have been basically sound for most fuels--sounder, in fact, than those of the United States (pp. 10-11, 233, and 289). In many ways, indeed, the energy sector shows the command economy at its best: The Soviets have resorted to widespread use of co-generation, for example, to provide simultaneously both electricity and heat; large electrical grids; early electrification of railroads; etc. Why then do the Soviets now find themselves in deep trouble?

Part of the reason is the same as in the West: overdependence on oil. For example, the Soviets converted from coal to liquid fuel for electricity generation far more completely than the Americans ever did,* and consequently now face the tough task of switching back. It is here that the present Soviet difficulty shows its underlying kinship to that of the rest of the industrialized world, for Soviets' present reliance on oil is a result of the same rapid response to low oil prices that took place all over the world following World War II, in the largest command economy no less than in the market-based ones.

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*Dienes and Shabad, pp. 35, 37. The share of coal in Soviet electrical power generation fell to 4.3 percent in 1975, compared to 59.3 percent in the United States. Whether Soviets have fully committed themselves to reversing this trend is unclear. According to a source cited by Dienes and Shabad, the FYP plan calls for a rise in the share of coal to 42.5 percent by 1980. Another source, however, shows a continued decline to 40.0 percent. See S. Iatrov, "Toplivno-energetischeskii kompleks," *Ekonomicheskaia Gazeta*, March 5, 1980, p. 10.

But the Soviets' special difficulty is that their vast energy supplies are far from the main industrial and residential centers, principally in the frozen tundra of Western Siberia, where punishing natural conditions discourage immigration, retard exploration and development, and send costs sky-high. One might say without too much exaggeration that the Soviets have less an energy problem than a problem in regional development and transportation.

The task of devising and implementing a solution is made more difficult by weaknesses in the Soviet political and administrative system. One might suppose, in view of what was just said about the overall rationality of Soviet energy development to date, that the current energy problem would be the sort of problem that the Soviet system should be especially well equipped to handle. After all, at least on the production side, energy development seems to call for precisely the kind of all-out, resource-mobilizing, campaign style that the Soviet system handles best. However, Dienes and Shabad show that in reality the Soviets face a much more complex challenge than that, one which will require making fundamental choices as great as any the regime has had to make since the earliest days of command industrialization in the 1920s and 30s.

These decisions are of two sorts: First, in order to maintain its present level of exports and at the same time to fuel the economic growth of the country, the Soviet leadership will have to decide which of its major potential energy sources should come first, or more exactly, what mix to strive for. Each presents very different problems. Oil is the most tempting, because of the phenomenal performance of the West Siberian oil fields during the 1970s. But there have been no new major discoveries in West Siberia since 1974, and given the difficulty of exploration there, it would be foolhardy to risk everything on the chance of discovering another super-giant soon.

Coal is undoubtedly a major part of any Soviet energy equation, but the sources next in line for development (Ekibastuz and Kansk-Achinsk) consist of lignites of uneven quality, high ash, low heat content, and tricky handling properties that will require major engineering

development simply to burn them, let alone to ship the resulting energy to points of use more than a thousand miles away. Nuclear power is likewise an indispensable part of the mix, especially since alone of all the major energy sources it can be concentrated near points of demand. This makes nuclear power an attractive long-term substitute for oil, especially in Eastern Europe. The CMEA nuclear program for the 1980s calls for the construction of as much as 37 gigawatts of new capacity to be built jointly inside and outside Soviet borders to supply electricity to Eastern Europe. Soviet planners hope this will replace approximately half of the present Soviet fuel exports there.* However, Dienes and Shabad observe that the Soviet nuclear program has suffered from major delays during the current five-year plan (1976-1980), and it is not clear how the Soviet Union could meet such an ambitious CMEA schedule, coming as it would on top of its own plans for nuclear power.

There remains gas. Soviet reserves in the northern region of Western Siberia are prodigious and reasonably well explored. Developing the fields and shipping the gas to European Russia, however, is an enormous task. To add increments of 100 billion cubic meters of West Siberian gas every two or three years during the 1980s, the Soviets will have to increase their output of rolled steel by one third by 1990 (p. 241). But an even more serious obstacle is the lack of infrastructure in the gas-producing areas. Already Urengoy, the country's largest gas field, is running behind schedule, and every sign points to a difficult battle ahead.

Regardless of what mix of alternative sources is finally adopted, it will require very substantial technological innovation, and here Soviet leaders will face a second array of fundamental choices. Take coal, for example: The poor quality and remote location of new sources will make it necessary to develop advanced techniques for long-distance high-voltage transmission of electricity, not to mention special combustion techniques and new strip-mining machinery. Other fuel sources are

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*See a recent article by Deputy Minister of Power F. Ia. Ovchinnikov, "Atomnoi energetike--chetvert' veka," *Teploenergetika*, No. 7, 1979, pp. 2-5.

only slightly less daunting in their requirements for research and development; they involve improving the manufacture and installation of pipelines and intermediate pumping stations for natural gas; developing new types of peak-coverage equipment such as pumped-storage hydropower, gas turbines or nuclear power plants that can be operated in a variable mode; increasing the efficiency of oil exploration and development (particularly drilling technology); adjusting the product mix of Soviet refineries toward lighter fractions (compared to the traditional Soviet emphasis on heavy fuels); and many more.

These technological requirements, in turn, impose a basic choice between near-term and long-term strategies. Both are theoretically available but at what cost? A short-term coping strategy might consist of rapidly expanding oil exploration in Western Siberia, forcing oil output in older production areas by means of advanced recovery techniques, developing a crash program to increase gas-pipeline construction, intensifying coal-mining in developed areas, and accelerating the construction of nuclear power plants. But such a strategy must work fast, and therefore it probably means turning to Eastern Europe and the West for skilled manpower, credits, and technology. A long-term development strategy, on the other hand, implies a greater reliance on domestic research and development, to solve basic problems like high-voltage transmission from Siberian and Kazakh brown-coal mines. Each of these strategies has its own promises and risks, and to judge from the recent Soviet press, its own ardent defenders.

Such basic choices are not new; they have been live issues in Soviet technology policy ever since the beginning of the Soviet era. The other book reviewed here, Robert Lewis' brief history of science and technology policy in the 1920s and 1930s, takes us back to the beginning when the fundamental choices involved in promoting rapid development were raised for perhaps the first time by any central government. What strikes the reader most is that, however much the scale and sophistication of Soviet science and technology have changed since those days, the basic questions have not. Then as now, Soviet commentators in the press criticized the industrial ministries for their neglect of research and their indifference to innovation. Then as now, the Soviets experimented with

varying degrees of centralization in R&D management. In the 1920s they tried a centralized agency for research and development, then abandoned it in the 1930s, but subsequently revived the idea in limited form in 1965 with the creation of the present-day State Committee for Science and Technology. In the 1920s and 1930s, the Soviets hesitated, even as they do now, between competing principles of funding. Complaints in the Soviet press about inefficiencies in the equipment and performance of research and development are just as loud today as they were then. Finally, still another issue with a familiar ring is the question of how much to displace native invention with foreign technology. The energy sector was among the ones most affected by such issues, because some of the earliest planned programs in technological development concerned large electrical power networks and underground coal gasification. Likewise, in scientific research, the 1920s and 30s saw the beginnings of excellent geological and gravimetric studies, which laid the basis for the subsequent development of the Soviet oil industry a generation later (p. 31.)

Such remarkable similarities cry out for an explanation. What could be more different, on the face of it, than the Soviet Union of the 1920s, with its embryonic industry and its handful of scientists and engineers, from today's superpower? Over the last half-century, the context of Soviet technology policy has changed radically. Why then are the issues being debated by the Soviets in R&D policy so similar to the ones of sixty years ago?

There are two main hypotheses, and Professor Lewis touches on both. The first is that the issues debated in the Soviet Union are the eternal questions of R&D policy everywhere, that organizational choices in R&D matter very much, and that Soviet problems in technology stem directly from the mode of organization chosen in the 1920s, which has remained largely unchanged since. The other hypothesis is that the organization of R&D matters less than the underlying organization of the economic system, which in the Soviet case has caused a chronic resistance to innovation by industrial ministries in all but the highest priority sectors. Which of these hypotheses is right? Both? Neither? (Understandably, the Soviets themselves favor the first.) Unfortunately,

Professor Lewis gets around to address these questions only in the last five pages of his book; and his carefully researched account is badly weakened by his failure to spell out for the reader, until the very end, just what questions he is trying to answer.

These issues in Soviet R&D policy are especially important when it comes to understanding why the Soviets innovate well in some areas and badly in others. From the beginning, certain branches of Soviet technology were treated on a special high-priority basis, quite different from the typical arrangements for the rest of the R&D sector, and in many of these the Soviets were successful in producing advanced technologies without major dependence on foreign help. Some of the most interesting and valuable information in Robert Lewis' book is devoted to showing how this was done in the aircraft industry, one of the most outstanding of all Soviet success stories. There, the military pioneered several of the management devices that are now being tried out in the civilian sector, such as "one-roof" development and design organizations (which group research institutes and pilot production facilities under a single management); institutionalized competition among prestigious designers; program management, etc. Political priority and innovative management appear to have gone together. However, political priority is a scarce resource by definition, and therefore cannot be extended beyond a small group of favored programs. One of the most important questions of Soviet R&D policy today is whether the management devices developed with such apparent success inside the high priority zone can be made to work outside it.

The energy sector got a mixture of treatments, ranging from high priority to low. Electric power was given particular attention from the start, which may help to explain why it is now the most advanced of the Soviet energy technologies, and the current excellence of Soviet nuclear power undoubtedly owes a lot to the fact that it was located from an early date at the junction of two high priority operations, the electrical and defense industries. However, the weakness of innovation in the other Soviet energy sectors, oil, coal, and gas, may be due less to low priority than to lack of need--until recently--for better technology. Oil exploration and development in particular,

appear to be remarkably inefficient, but this may be due in large part simply to recent abundance. Does it follow, however, that once the priority of energy rises in the leaders' minds and new finds grow scarce, Soviet energy technology will be able to rise rapidly to the occasion? Lewis' account suggests two other possibilities: Once the pressure for fast results in production passes a critical point, the result may be not more domestic innovation but less, as near-term concerns drive out the long-term. That is what happened at the end of the 1920s. In the campaign atmosphere of the first five-year plans, the supreme goal was to increase output fast. In most fields the scientist and technologist were given neither the time nor the leisure for domestic technological innovation.

But today's leaders do not have the option of responding in the same extreme fashion as Stalin did then. In the 1930s, planned development involved mobilizing mass enthusiasm and fear to execute a relatively small number of tasks on a massive scale. Now Soviet success in the energy sector depends heavily on managing rapidly growing scarcity and complexity, bringing together an increasingly independent-minded labor force and resources located in intractable forms or inaccessible places, increasing simultaneously the carrying capacity but also the sophistication and efficiency of means of energy transport, and finding ways compatible with the command system of altering the energy-wasting behavior of local decisionmakers. Those are tall orders. In these ways the Soviet energy problem, and particularly the technological choices arising out of it, tests the adaptive capacities of the entire political system, in some ways even more than did the heroic days of the first five-year plans. Will the regime be able to meet the challenge?

On the first set of choices mentioned above, that of setting priorities among competing mixes of energy sources, the response of the Soviet leadership so far has been uncertain. Over the last five years, official policy has lurched first in one direction and then in another. It began, during the first half of the 1970s, by stressing the development of coal resources. Then, in late 1977, the leadership opted instead for a crash program to develop West Siberian oil. This was followed last year by a return to a more balanced policy in which gas and nuclear power

have replaced coal as the prime candidates for high priority expansion. How should one interpret this vacillation? Is it the result of pulling and hauling by various interest groups and regional spokesmen? Or does it show the central leadership gradually coming to grips, by successive and not necessarily coherent stages, with the full implications of a complex problem with no easy solutions? At this point we do not know enough to tell.

As for the second range of choices described here, that between the near and the far term, we shall be able to follow the evolution of the leaders' preferences by observing the choices they make in technology policy. A major effort to improve native technology in energy will require a corresponding effort to deal with the chronic problems that have hindered innovation in the energy sector in the past, either by giving it higher political priority (as in the defense sector) or by promoting management reforms. But high political priority is the scarcest of all resources; can it be successfully stretched to include the energy sector? As for management reforms, Lewis reminds us that the historical Soviet response to management problems has been to redraw the organization chart and hope for the best. Will the current Soviet political elite, which has shown no great stomach for major reform in the last 15 years, have the imagination and decisiveness in the next decade to depart from the historical pattern? Perhaps the surest and most profitable Soviet response is to turn to Western Europe for help, thus strengthening a growing Soviet-West European community of interest in energy matters.

Thus each major industrial power wrestles with its own particular version of the energy problem, and brings to it its own special strengths and weaknesses, as it shifts from the era of cheap hydrocarbons to a more complicated and dangerous age. One dominant thought Dienes and Shabad leave in our minds is the vastness of Soviet energy resources beyond the next decade or two. Though never cheap, though temporarily scarce, they are abundant. The long-term danger that should perhaps be on American policymakers' minds is less that the Soviets may plunge toward the Persian Gulf after oil than that they will almost certainly use both their technology needs and their potential energy resources as levers in Western Europe.