~~Confidential~~ S-6119

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TO : Milton Kovner, Department of State

SUBJECT: Questions on Soviet Energy Capabilities

Attached is our attempt to answer your questions on Soviet energy capabilities. We have enlisted OSI's support to answer the question on alternative energy sources. Unfortunately, we are unable to respond to the question on energy related environmental technology.

Since no request was made for information on nuclear power, we assume that the AEC is responding to your needs on this subject.

If you need additional information to supplement what has been provided in some haste, please call at your convenience.

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What are the Soviet capabilities in technology affecting the development of conventional energy sources, such as coal?

Although in a few specific cases Soviet technology might be useful to the US coal mining industry, the USSR lags behind the US in most phases of coal mining technology -- underground mining, strip mining, and coal preparation. Much of the Soviet lag can be traced to a decision in the early 1960s, when investment in the coal industry was curtailed in favor of more rapid expansion of the oil and natural gas industries. Subsequently, the leadership decided to modernize the coal industry and launched a formal program covering the period 1968-75.

The USSR lags far behind the US in strip mining technology. For example, the USSR is now in the process of designing and developing draglines with bucket capacities of 80 cubic meters, but this is less than half the capacity of the largest dragline produced in the US. The USSR, in fact, has purchased some of this technology abroad. Strip mining equipment has been imported from East Germany, while small amounts of other types of equipment have been purchased from non-Communist countries.

A [ ] delegation that visited the USSR in 1970 concluded that Soviet mining machines generally do not appear to be applicable under most [ ] mining conditions. They noted, however, that one particular type of roof support mechanism might be useful if greater application is made of long-wall

mining methods[ ] Hydraulic mining of coal is another area in which the USSR might have something to offer[ ] [ ] sees definite commercial possibilities for this technology; a[ ] delegation was scheduled to go to the USSR in April 1974 to initiate discussions on cooperation with the USSR in this field.

Another aspect of Soviet coal mining technology that might be useful[ ] relates to deep coal seams. Thes seams are often gaseous and subject to outbursts of gas and rock. [ ] on coal mining safety that inspected Soviet coal mines in 1973 concluded that the USSR is ahead of[ ] in the development and use of shield-type supports.

What do we need in the way of Soviet data not already published on production, demand, consumption, and trade of forms of energy? How valuable would forward estimates be in these areas?

Soviet published data on overall production and trade of the major forms of energy -- oil, natural gas, coal, electric power -- are generally adequate for our needs. In recent years, however, Soviet trade statistics on oil no longer reveal a breakdown of deliveries of crude oil and petroleum products to importing countries. Such a breakdown of oil trade statistics in the format available through the 1960s would be helpful in assessing the flow of Soviet oil exports.

Information on Soviet consumption of and demand for oil, natural gas, coal, and electric power is not available from published sources. Such data would be extremely useful, especially consumption of energy by major economic sectors, to evaluate Soviet industrial growth and estimate future growth in Soviet energy use. In particular, we would like to know about inventories of oil, output of petroleum products, refinery capacity, uranium supplies, capacities of gaseous diffusion plants, and costs of construction and operation of nuclear power plants.

Very little reliable information is available from Soviet sources on plans and forecasts for energy production and trade beyond 1975. Acquisition of Soviet estimates for the future

would be invaluable in assessing the Soviet position in the future world energy picture. Information especially needed to determine future Soviet energy capabilities includes proved reserves of oil and gas in Siberia, planned production and imports of oilfield and coal mining equipment, plans for offshore exploration for oil and gas, planned expansion of nuclear powerplant capacity, and investment (total and regional) in the various energy sectors.

What are Soviet capabilities for developing alternative energy sources, for example, solar and synthetic fuels?

Magnetohydrodynamic Power Generation

Magnetohydrodynamic power generation (MHD) is essentially a coal-based technology, since it can be fired directly with coal, or from gas generated from a coal gasifier attached to the end of an MHD generator. Moreover, recent results of coal-fired MHD experiments indicate that coal-slag may be an excellent protective coating capable of extending the lifetime of MHD electrodes. The US leads the world in studies on coal-fired MHD. The Soviets chose natural gas as the primary fuel for their MHD generators. However, they are now prepared to switch to coal-fired MHD because of the promise of this technique and because they realize that their natural gas supplies are too valuable a commodity to be used as a fuel for electric power production.

The Soviets lack the technical sophistication of the US in such areas as computer modeling of the MHD flow process, generator design, superconducting magnets, and extraction of large power outputs. Although the Soviets have done more materials work -- materials development is critical to the success of MHD -- there have been no significant results. The US has done far less materials R&D and has taken a different

approach. Only now is a significant materials effort for MHD being undertaken in this country. However, based upon the Soviet's experience, this late start does not appear to have put the US at a disadvantage to the Soviets.

The only area where the USSR really leads the US is in the "nuts-and-bolts" department. The Soviets have a large, long-duration test facility, the U-25. Through the US-USSR MHD exchange program, the US will build an MHD duct to be tested in the U-25; the Soviets will receive in return access to US technical expertise and to a US superconducting magnet for testing on a smaller MHD generator, the U-02. The program seems to be, at the moment, a fairly equal "quid pro quo."

Synthetic Fuels

The Soviet Union has large reserves of oil and natural gas. It makes little sense for the Soviets to develop a synthetic fuels industry when they have such large quantities of these clean, easily transportable, and -- in some cases -- readily extractable fuels. It is doubtful, then, if the Soviet Union has any expertise in synthetic fuels comparable to that found in the US.

Geothermal Energy

The Soviets have been investigating the possibility of using geothermal energy sources for power generation for a number of years but they have been slow in building power plants. The

only known operating plants at the present time are some fairly low capacity plants in Kamchatka. The Soviets therefore are generally behind the US and several other Western countries in using geothermal energy sources for generating electrical power. Furthermore, the Soviet impetus for developing such power sources currently seems to be less than that of the US.

The exploitation of geothermal water for non-electric power purposes has received more emphasis in the USSR. Several towns and industries have been supplied with hot water for heating and cooling purposes. In this part of the problem, the Soviets probably are about on a par with the West.

The Soviets have had in operation since about 1967 a small geothermal power station utilizing freon as a heat exchanging medium. Because of this experience, they possibly could have some useful technological data to share with the US. They also have active plans to use underground nuclear devices to fracture rocks, thereby allowing water to be pumped in from the surface to absorb the heat. These Soviet plans may be in a fairly advanced stage, and useful information in this area probably is available if they are willing to share it.

Solar Photovoltaic Converters

In the use of photovoltaic or solar cells the Soviets have an overall capability comparable to that of the US. Their solar cell program has been mainly oriented toward space applications. Silicon cells, comparable to those used in the West, are used by the Soviets and considered by them to be the best for near earth applications. They have fabricated gallium arsenide cells and consider them superior for use in extreme regions of space because of good high temperature properties and better operation at low levels of light illumination.

Two Soviet developed photovoltaic systems offer promise for improvements over presently used solar cells. These are a vertically illuminated silicon cell, the "Photovolt", and heterojunction gallium arsenide-gallium aluminum arsenide solar cells. The Soviets probably have used the "Photovolt" in space applications, specifically in systems where high voltage is required. They claim that for terrestrial applications, with solar concentrates and water cooling, they can obtain a power output that is much greater than that of ordinary silicon solar cells. These claims have not as yet been proven.

The gallium arsenide-gallium aluminum arsenide heterojunction cell may be more efficient that any of the silicon cells. Information about Soviet prototype devices using this material is not available. But its development has picked up outside the USSR and appears promising.

What are Soviet capabilities in exploration technology, especially oil and gas?

In general, the level of petroleum exploration technology in the USSR is about 10 to 15 years behind that in the US. In the geophysical aspect of exploration, the Soviets are good in theory but relatively backward in practical application. They are just getting underway on the use of digital computer field recording units and development of playback centers to process seismic data. Such operations have been employed in Western oil and gas exploration for more than 10 years. The lack of such equipment in the USSR has hindered Soviet efforts to explore deep formations (below 2,500 meters) and to map deep complex faulted strata and permafrost areas.

Even when petroleum prospects are located, Soviet efforts in drilling, testing, and logging of wells are hampered by technical deficiencies. Their extensive use of turbodrilling, instead of rotary drilling, has caused problems because the turbodrill is inefficient for drilling to depths below 2,000 meters. Drilling operations in general are inefficient because of poor quality drill bits, poorly developed drilling fluids, and inadeuate blowout preventor equipment. Drilling in the Siberian permafrost regions is a particularly difficult job.

Soviet equipment is inferior to Western equipment for evaluation of potential oil and gas reservoirs where high temperatures and pressures are encountered, usually at considerable depths. Soviet drillers spent 4 years drilling an exploratory well to a depth of 21,000 feet. US drillers normally drill such a well in about 6 months.

CIA Publications Dealing with
Soviet Energy

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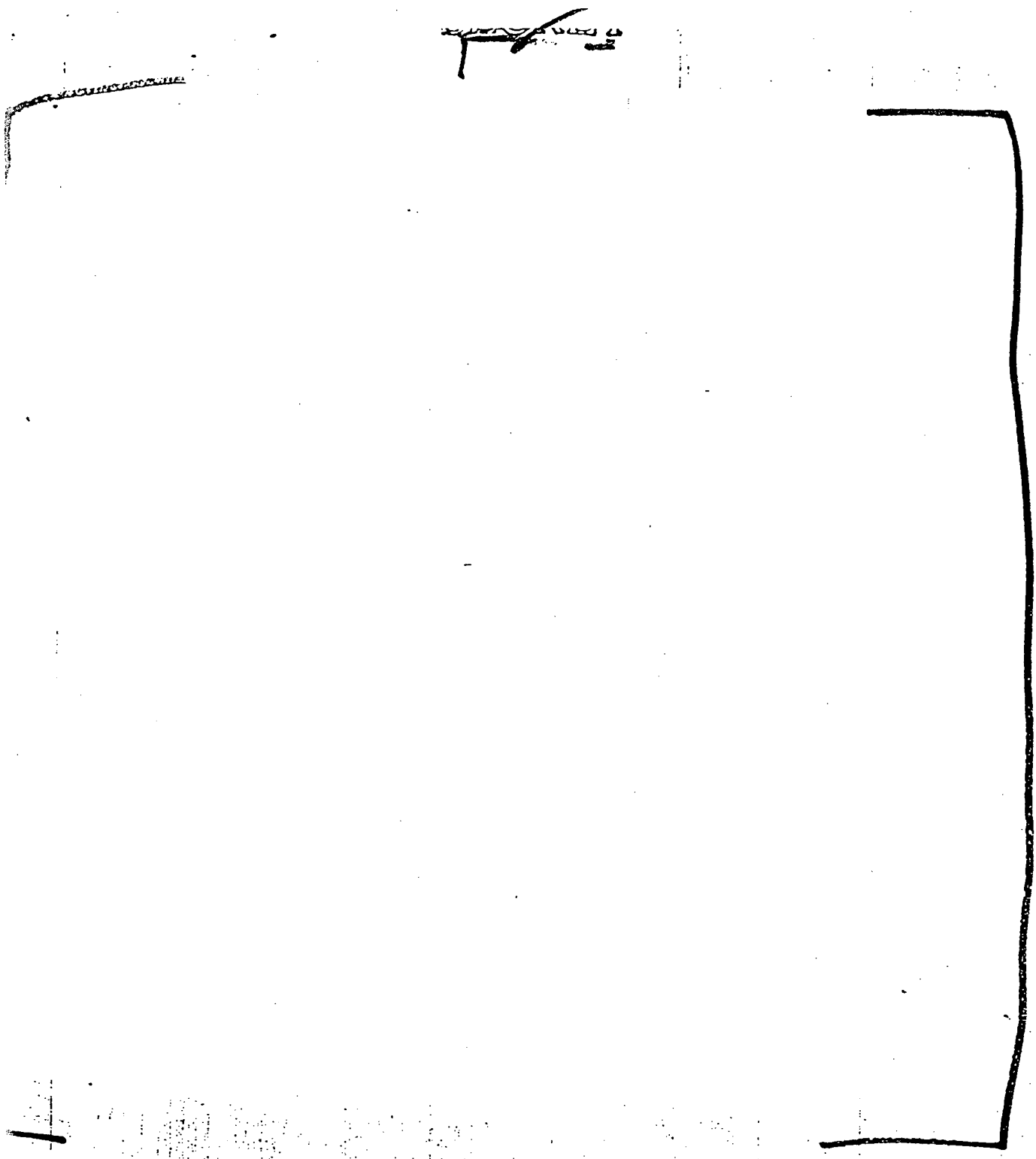

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