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The Current Status of the Soviet Nuclear Power Program

REPORT NO. 1-58

29 MAY 1958

JOINT ATOMIC ENERGY INTELLIGENCE COMMITTEE

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This report was prepared by the Nuclear Energy Division, Office of Scientific Intelligence, Central Intelligence Agency. It was approved by the Joint Atomic Energy Intelligence Committee which is composed of representatives of the Departments of State, Army, Navy, Air Force, the Atomic Energy Commission, the Joint Staff, and the Central Intelligence Agency. The FBI abstained, the subject being outside of its jurisdiction. See appropriate footnotes, however, for the dissenting views of the Navy member.

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The Current Status of the Soviet Nuclear Power Program

THE PROBLEM

To determine the current status of the Soviet nuclear-electric power program and its expected growth through 1960.

SUMMARY AND CONCLUSIONS

1. In February 1956, the Soviets announced a nuclear power program calling for a total installed capacity of 2,000–2,500 electrical megawatts (EMW) by 1960. Indications that the power program will not attain this figure by 1960 were contained in a Soviet reply to a UN questionnaire in March 1957, which described a program calling for three large stations and four experimental stations, the total capacity of which appeared to be about 1,400 EMW. Two of these large stations were rated at 420 EMW apiece and each were to comprise two pressurized water-moderated, water-cooled reactors (PWR—or same general type as at Shippingport). The third, rated at 400 EMW, was to use two reactors modeled after the first atomic power station at Obninskoye, i.e., graphite-moderated and water-cooled. The four experimental stations would have a total capacity of about 160 EMW. In NIE 11-2-57, we estimated that the Soviets could achieve 1,400 EMW by 1960 with a priority effort.

2. Recent statements by Soviet officials indicate that only two of the large stations are actually under construction, and these are in early stages. One PWR station is now to be completed in 1960 while the station with graphite-moderated reactors will probably have only one reactor of about 100 EMW capacity installed by the end of 1960. Thus, if all four experimental stations are completed by 1960, the USSR would then have a total of about 700 instead of 1,400 EMW of installed nuclear-electric generating capacity.

3. The above capacity probably does not include any power obtained from dual purpose reactors optimized for plutonium production with by-product electric power. Such reactors would be located at Soviet classified fissionable material production sites. We estimate that the Soviets will obtain 200 or more EMW from such reactors through 1960. This would give them a total of at least 900 EMW of installed nuclear-electric generating capacity at that time.*

4. Despite the fact that the goal of 2,000–2,500 EMW during the Sixth Five-Year Plan obviously will not be met, leading Soviet authorities are still quoting this figure in

*See Navy footnote on page 5.

connection with nuclear power plants. This indicates that the Soviet program has probably not been modified downwards, but only stretched out in time. This progressive decrease in the amount of nuclear generating capacity to be installed through 1960 indicates that the Soviets were overly optimistic with regard to their ability to solve quickly the technical problems associated with building and operating large-scale power reactors. (The slippage in Soviet plans for building nuclear power stations is illustrated by the chart on the next page.)

DISCUSSION

1. The Soviet Sixth Five-Year Plan included a February 1956 announcement calling for the construction of nuclear-electric power stations with an installed capacity of 2,000 to 2,500 electrical megawatts (EMW) by the end of 1960.[1] The most authoritative discussion of this program was given by Academician I. V. Kurchatov at Harwell in April 1956 in his speech "Some Aspects of Atomic Power Development in the USSR."[2] Kurchatov stated that "five prototype atomic power stations will be built in the 1955–1960 period. According to this program, the stations will be put into operation after 1958; some will go into operation in 1959, and some in 1960." Kurchatov earlier in the speech had stated that the large power stations would have a capacity of 400–600 EMW each. Two of the stations would employ pressurized-water reactors, one would use graphite-moderated, water-cooled reactors of the "First in the World" Atomic Power Station (APS–1) type, and the station of the third type would employ gas-cooled, heavy-water moderated reactors. Kurchatov continued as follows: "In addition to these three types of large atomic power stations, we will build and put into operation several experimental atomic installations with electric power of 50–70 EMW each." He then listed four reactors: a boiling-water type; a homogeneous thorium breeder; a graphite-moderated, sodium-cooled reactor; and a fast plutonium breeder. Kurchatov mentioned five prototype atomic power stations and then specified only four large stations. It is not clear whether the fifth was composed of the four experimental reactors or was one of the three types previously described. In NIE 11–2–57, *The Soviet Atomic Energy Program,* we estimated that the Soviets would not achieve their goal of 2,000–2,500 EMW of installed nuclear-electric generating capacity by the end of 1960 even with a very high-priority effort.

2. The first hint that all was not well with the USSR's nuclear power program came in March 1957 in the form of the Soviet reply to a United Nations questionnaire on nuclear power.[3] The following changes were noted from Kurchatov's Harwell speech: 1) no mention was made of the station using heavy-water moderated, gas-cooled reactors; 2) no date was set for completion of the two large PWR stations (called Project I) and the graphite-moderated reactor station (called Project II); 3) the power level was fixed at 420 EMW for the PWR stations and 400 EMW for the APS–1 type station. The Soviet reply to the UN questionnaire thus indicated a total installed capacity of about 1,400 EMW through 1960. In NIE 11–2–57, we estimate that the Soviets could achieve 1,400 EMW by 1960 with a high-priority effort.

3. The Soviet papers on nuclear power presented at the Belgrade World Power Conference[4] held in June 1957 made seemingly slight, but important, changes in the situation reflected by the reply to the UN questionnaire. First, the Soviet delegate, S. A. Skvortsov, in discussions stated clearly that a 420 EMW PWR-type station was being built (instead of "will be built") in the central European USSR and a detailed

SOVIET NUCLEAR POWER PROGRAM

(TO BE COMPLETED BY THE END OF 1960)

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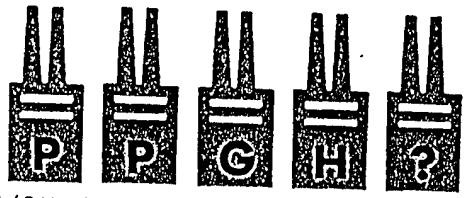
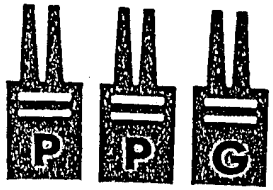
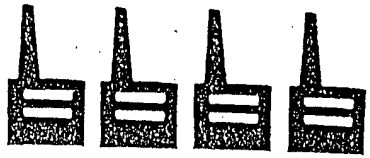
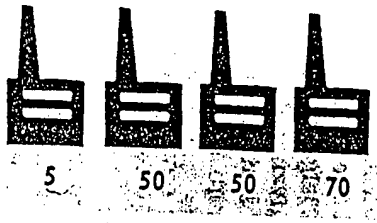
NOFORN

	ORIGINAL PLAN FEBRUARY 1956 2,000 - 2,500 EMW	APPARENT REVISION MARCH 1957 1,400 EMW	CURRENT ESTIMATE 900 EMW
LARGE-SCALE PLANTS			
CAPACITY (EMW)	400 – 600 EACH	420 420 400	420 100 (PARTIAL OPERATION) 200+ (BY-PRODUCT POWER)
SMALLER EXPERIMENTAL PLANTS	"SEVERAL" WITH CAPACITY OF 5 - 70 EMW EACH		
CAPACITY (EMW)		5 50 50 70	5 50 50 70

P PRESSURIZED WATER REACTORS

H HEAVY-WATER-MODERATED GAS-COOLED REACTORS

G GRAPHITE-MODERATED, WATER-COOLED REACTORS

EMW ELECTRICAL MEGAWATTS

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description of the station was given in a separate paper. Quoting from the latter paper, "it is expected that the station will begin to supply the grid in 1960." No such description was given in Belgrade for the APS–1 type station, a fairly preliminary design of the latter being given only in the November 1957 issue of "Atomnaya Energiya." Second, it was not stated directly that *two* of the Project I stations would be built, as it was in the reply to the UN questionnaire.

4. The above developments, i.e., the apparent dropping or deferring of the station employing heavy-water moderated, gas-cooled reactors and the implied decision to begin construction of the PWR station before the APS–1 type seem to indicate that Kurchatov is the guiding hand in the Soviet nuclear power program. In discussions with Western scientists in 1956, Kurchatov indicated that the gas-cooled, heavy-water system might not proceed much further. He also said that he personally did not favor the APS–1 reactor and seemed in general to be promoting the economic advantages of the PWR type.

5. In evaluating the Soviet nuclear power program, considerable weight has been given to the reply to the UN questionnaire and the Belgrade papers because these seem to contain a truer appraisal of their progress than releases aimed at the national audience. The Soviets have never stated directly that the original goal of 2,000–2,500 EMW by the end of 1960 will not be met. On the contrary, in the November 1957 issue of "Atomnaya Energiya," N. A. Nikolayev, Deputy Chief of the Main Administration on the Use of Atomic Energy, blithely talks of 2,000–2,500 EMW during the Sixth Five-Year Plan and outlines a program essentially the same as that described by Kurchatov in April 1956. Khrushchev, as recently as March 19, 1958, told a French newspaper correspondent that atomic power plants with a capacity of 2,000–2,500 EMW would be built within the next few years, omitting any reference to 1960.[5]

6. Thus, any failures or lack of progress in the Soviet program must be inferred from their current statements on the large power stations. For example, G. V. Yermakov of the Ministry of Electric Power Stations "Glavatomenergo," in discussing the Soviet nuclear power program, described the large PWR station under the caption "The First Giant of Atomic Power Engineering." He said that "its first section with a power of 420 EMW in 1960 will produce industrial current which will be fed into the unified power systems of the European USSR."[6] Several other articles mention only one large nuclear power station under construction in 1957.[7 8 9] Thus, it appears quite definite that only one large PWR station will be in operation by 1960. The tempo of construction of the large graphite-moderated station is not described so explicitly by the Soviets, but the indications are that it is not progressing as fast as the PWR and that perhaps only one reactor of 100 EMW capacity will be installed by 1960.[9 10]

7. In the absence of further evidence, we assume that the Soviets will accord priority to the construction of their four experimental reactors included in the Sixth Five-Year Plan. The completion of these projects should provide them with a total of about 700 EMW of installed nuclear-electric generating capacity in 1960.

8. The above estimate is based entirely on what the Soviets have openly told us in conferences, questionnaires, or published statements. However, there is good reason to believe that the Soviets are using some of their plutonium-producing reactors for by-product power. In 1956, Kurchatov said that the heat from future plutonium-producing reactors would be used, and we believe power is clearly a logical use.

9. In addition, a recent report describing the Tomsk atomic energy installation mentions three reactors, one in operation, one almost ready for service, and the third in the initial stages of construction.[11] The reactor in operation is apparently a straight production reactor, but the second and third reactors have associated with them a power-generating building and cooling towers. Reportedly, three 70-MW turbines are to be installed in the power-generating building, giving total by-product power of about 200 EMW. Since the Soviets may be obtaining by-product electric power from plutonium production reactors at other sites, e.g., Kyshtym and Krasnoyarsk, we estimate that the Soviets will obtain at least 200 or more EMW from such reactors through 1960.*

10. There exists the possibility that the Soviets in their original 2,000 to 2,500 EMW plan included power from such dual-purpose reactors but decided to omit mention of this type of plant in the reply to the UN questionnaire and in their Belgrade papers. Even if the above dual purpose reactors were included in the original plan, the Soviets still would not attain 2,000–2,500 EMW by 1960. The evidence available at this time is not sufficient to justify a positive conclusion as to whether dual-purpose production reactors were an integral part of the original program.

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*The Navy representative disagrees with the estimate of by-product electric power from plutonium production reactors. He believes that this is only one possible conclusion from some highly debatable intelligence, and that other conclusions are more plausible. For instance, (1) this information may relate to one or more of the four experimental power stations described in paragraph 1; or (2) the information may relate to prototype propulsion reactors not included in the power program.

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